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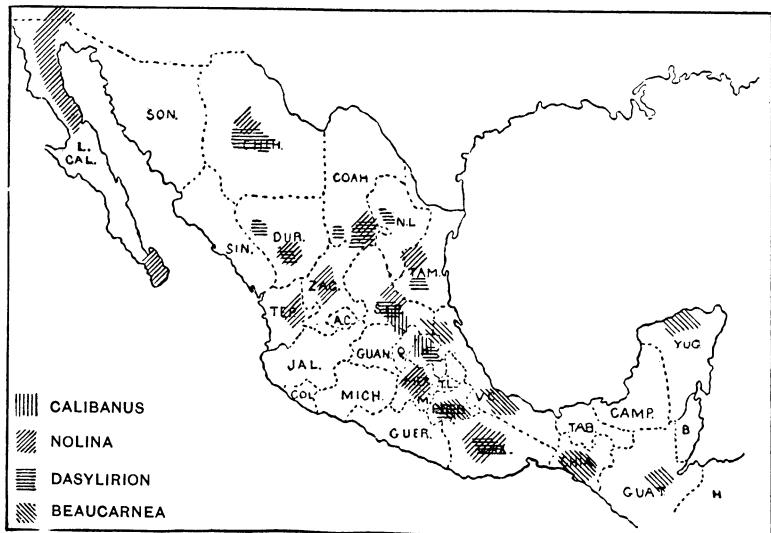
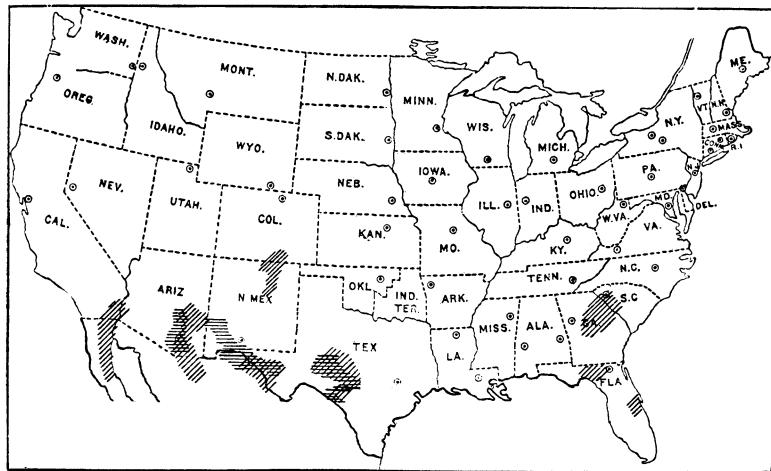
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DISTRIBUTION OF NOLINEÆ

## THE DESERT GROUP NOLINEÆ.

(PLATES I-XVII.)

By WILLIAM TRELEASE.

(Read April 21, 1911.)

### HISTORY.

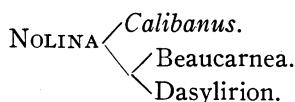
The four genera *Nolina* (Michaux, 1803), *Dasyllirion* (Zuccarini, 1838), *Beaucarnea* (Lémaire, 1861) and *Calibanus* (Rose, 1906) form so natural a group that many botanists have considered a single generic name, *Dasyllirion*, sufficient for all, though they differ enough in fruit to have caused the founder of this genus to question the propriety of including in it all of the species that were known even in his day; and they show marked differences in habit.

Except that *Dasyllirion* was based in part on a *Hechtia*, which led its author—who later recognized the error—to place it among the Bromeliaceæ, and that on his suggestion it has been connected transiently with the Juncaceæ, this genus and its immediate relatives have been accorded place generally among what are now considered as Liliaceæ,—though not always under that family when its rather heterogeneous components have suffered temporary segregation. No better arrangement has been found than that of Engler and Prantl<sup>5</sup> who locate the Nolineæ between Yuccæ and Dracæneæ as part of the Draceanoid Liliaceæ. From the Yuccæ they are sharply differentiated, among other characters, by their small polygamo-dioecious flowers (never 10 mm. in diameter), few-ovuled pistil, and small usually indehiscent fruit rarely more than one-seeded: and the Dracæneæ differ from them in a usually somewhat gamophylloous perianth, perfect flowers, and prevailingly fleshy fruit,—but in all of these respects the group of Dracæneæ offers a good deal of latitude.

## DISTRIBUTION AND ORIGIN.

Like the Yuccæ, the Nolineæ are all North American, and they are comparably distributed except that none are known from the West Indies. They are among the characteristic plants of the dry temperate backbone of the continent. None extend north of southern Colorado, and no species is known to have a very extended range. Their focal center is evidently the temperate Mexican tableland, on which the genera are all represented and to which the majority of their species are confined, *Beaucarnea* alone, in its most typical form, being characteristic of the hot country and ranging into Central America. Of the two genera that reach the United States, *Nolina* only enters into the Californian flora, and that only in the southern desert. Though unrepresented in the intermediate region, from which it may be assumed to have disappeared, this genus also appears in the South Atlantic states, apparently as an offset from the grass-leaved Texan stock, rather than indicating its primal home (*map*).

The ontogeny of the group is scarcely more than a matter of speculation. No reason is apparent for considering it to be very ancient. Though evidently related to the typically septicidal Yuccæ, it seems rather more likely to have had a closer evolutionary connection with the typically loculicidal Dracæneæ. More satisfactory hypotheses may be held concerning the affinities of the component genera. *Nolina* may be taken as most closely approaching the prototype of the group because of its extensive range, large number of species composing differentiated groups, and conformity to the liliaceous plan in its 3-celled pistil and cotyledonary arch. *Calibanus* appears to be an offset of *Nolina*. *Beaucarnea* and *Dasyliion*, with a single-celled pistil, may represent parallel offshoots from *Nolina* or a no-longer recognized derivative of that genus; and the question may be raised whether *Beaucarnea* is more than a well-marked subgenus of *Dasyliion* which, strictly limited, itself consists of two quite dissimilar groups. These affinities may be indicated as follows:



## BIOLOGY.

All Nolineæ are perennial, and, as would be expected from their habitats, they are pronounced xerophytes with a rather succulent caudex,<sup>7</sup> either small and insignificant or moderately developed, and then either prostrate or erect, or even of tree size (*pl. 1-4*), and rather hard usually rough-edged or even prickly leaves<sup>3,6</sup> covered by a well-cuticularized epidermis, the stomata usually arranged in lines overlying the parenchyma between strong fibrous bundles and either furnished with an outer vestibule as in *Agave*, etc. (*Dasylirion*), or located between prominent ribs that, especially in *Nolina*, are often covered with more or less interlocking papillæ.<sup>13,16</sup> They occur most strikingly in such desert associations<sup>2</sup> as count *Agave*, *Yucca* and *Hechtia* among their characteristic components (*pl. 2, 4*). In many species the tip of the leaf shreds into a sometimes brush-like bunch of fibers, and in one (*Nolina Bigelovii*) the margin breaks away sparingly—in kind, rather than quantity, recalling the fibrous exfoliation characteristic of many yuccas and of one large group of spicate agaves. From a study of the leaf-tip of *Dasylirion acrotriche*, Zuccarini<sup>24</sup> was led to believe that what passes for the leaf is really a petiole with ventral ligule, the blade, considered as peltate, being represented by the more dorsal shreds only. The prevalent dorsal insertion of the haustorium on the cotyledonary sheath in seedlings of this group is worthy of note in connection with this opinion (*pl. 15*).

Though sometimes weakened or even destroyed by flowering under cultivation, all of the Nolineæ appear to be normally polycarpic. The terminal inflorescence<sup>1,24</sup> is essentially of one type though varied from a thin lax raceme-like wand into a stout compound spike with short and broad divisions or an open simple, compound or even decompound panicle (*pl. 5*). Whatever its form, the flowers are clustered, usually two or three together, in the axils of small prevailingly denticulate bractlets, either on cushions so short that they appear to come from the main axis, or, more commonly, on evident secondary or tertiary branches (*pl. 6, 7*). The primary branches appear to be 8-ranked<sup>17</sup> and the bracts are often large and conspicuous, those which support the ultimate flower clusters being scarcely larger than the bractlets.

The sometimes slightly fragrant<sup>11</sup> polygamo-dioecious flowers are borne on slender pedicels never greatly exceeding their own length, which are always distinctly jointed, usually about the middle. Though the flowers are small, their at first petaloid, then scarious-persistent distinct entire or toothed segments are usually whitish, though more or less tinged with green, violet, rose or cream—a coloration supported by the usual whiteness of the scarious bractlets and, often, by similarly colored large bracts. The small elliptical anthers are introrsely versatile, their filaments slightly adnate to the base of the perianth segments. Three connate carpels, with typically two anatropous basal ovules each, constitute the pistil which is 1- or 3-celled in different genera. The stigmas are essentially apical, on more or less free and divergent style tips in *Nolina*, crowning the rather narrowed ovary in *Beaucarnea*, along the rim of a distinct funnel-like though sometimes cleft style in *Dasyllirion*, or as sessile points in *Calibanus* (*pl. 8*).

Essentially unisexual and often dioecious, the flowers are perfect in plan; and abortive stamens are found in the fertile flowers, and more or less recognizable rudimentary pistils in those that are functionally staminate. In fertile flowers nectar is secreted by small septal nectar-slits in the base of the pistil,—often very evident after this has enlarged into a fruit (*pl. 9*); and in staminate flowers it is the rudiments of the carpels that perform the same function.<sup>24</sup>

Though prevailingly 3-merous, the flowers may show deviation from this pattern. Preda<sup>17</sup> noted that about one-fifth of the flowers of a pistillate plant of *Dasyllirion glaucum* were 4-merous; and in examining large numbers of the fruits of this genus I have observed 2-, 4- or 5-winged fruits of several species and one 4-carpellary fruit of *Calibanus* (*pl. 11*). Several observers have found that partly developed fruits may occur now and then on staminate plants<sup>8</sup>; my own observation shows that well developed stamens may be found in some pistillate flowers; and Bouché<sup>1</sup> records the transformation of staminate into pistillate individuals,—suggesting an interesting line of study for those who may observe and experiment with these plants as they grow under natural conditions.

Observations on pollination do not appear to have been recorded, but the flowers are clearly entomophilous and their pollina-

tors are to be sought probably among the Hymenoptera and Diptera, as has been suggested to me for *Dasyllirion* by Sr. Patoni, of Durango.

Normally fertilized, the ovules develop into 3-sided or 3-grooved seeds with micropyle by the side of the hilum, a slender often scarcely discernible raphe, and thin and smooth or somewhat thickened and wrinkled envelopes composed of thin-walled cells and representing essentially the seed-coats though often with a terminal umbo or apiculus representing the base of the nucellar tissue. The bulk of the seed consists of rather firm endosperm through which the finger-like embryo passes upward from near the micropyle toward the morphological base of the nucellus. The endosperm consists of moderate-sized polygonal cells with glistening white rather thick pitted walls and coarsely granular contents destitute of starch. The walls of these cells are of the "reserve-cellulose" type, but they are colored blue by neither iodine nor chlor-iodide of zinc, though they swell so greatly in the latter reagent that in a thick section the contents, in which large and abundant oil drops separate out, promptly extrude, sausage-like, from any chance break (*pl. 10*). Went and Blaauw<sup>22</sup> have reported partial embryo formation in some ovules and much more complete endosperm development in others, in a pistillate *Dasyllirion*,—apparently without concurrence of male nuclei. Usually only one of the six ovules produced by a normal pistil matures in the 1-celled fruit of *Dasyllirion* and *Beaucarnea* or the 3-celled ovary of *Calibanus*; but with the 3-celled fruit in *Nolina*, though a single seed is the rule, two or three are not infrequently seen,—usually only one to a cell, though exceptionally both ovules of a carpel develop.

The ripened fruit is dry-walled: subglobose with three low ribs in *Calibanus*, triangular with strongly developed dorsal wings on the carpels in *Dasyllirion* and *Beaucarnea*, and deeply 3-lobed between the wingless carpels in *Nolina*. In the first three genera it does not dehisce, but in *Nolina*, though the delicate walls are often irregularly torn—sometimes even before maturity of the rather firmly attached seed, or the fruit may remain long unopened—loculicidal dehiscence is more or less prevalent (*pl. 11, 12*).

If observations on dissemination have been published, they have

escaped my search, but the process may be inferred with some probability from the character of the fruit. In all, the ripened fruit, with its enclosed or attached seed or seeds and the persistent but unenlarged perianth, falls by disarticulation of the pedicel,—close to the fruit in *Dasyliion* and *Calibanus*, somewhat further from it in *Beaucarnea*, and usually at a still greater distance in *Nolina*. No provision for dissemination other than through rolling or being blown over the ground appears in the round fruit of *Calibanus*. The winged fruits of *Dasyliion* and *Beaucarnea* are as evidently wind-scattered as the similarly disarticulating and equally small fruits of *Rumex*,—though in the latter the wings are not carpillary but consist of the enlarged persistent sepals. The very different fruits of *Nolina* are likewise evidently wind-disseminated, their more or less inflated carpels giving them a character intermediate between winged and balloon fruits.

Germination, of which no published records have been found, is of Klebs' *Asphodelus-Tradescantia* type,<sup>10,20</sup> the seed—freed from the remnants of the fruit in *Nolina* or still contained in them in the other genera—remaining in the ground with the arched haustorium elongating with the cotyledonary sheath so as to reach a length of even 10 mm. In *Nolina longifolia* and in specimens of *N. parviflora* preserved by Dr. Rose, the haustorium is apical, though a slight elbowing is sometimes seen near the top of the arch; and it sometimes straightens and lifts the seed from the ground. Seedlings of *Beaucarnea* and *Calibanus* preserved by Dr. Rose show that in these genera the sheath is produced above the arch in form of a pointed ventral ligule, as is true in such species of *Dasyliion* as I have observed. In these cases the haustorium appears to be distinctly dorsal on the sheath, along which it is often sharply refracted (*pl. 13-15*). Initial growth is evidently at the principal expense of the granular protoplasm, oil and "reserve-cellulose" of the endosperm. In *Calibanus* and *Beaucarnea*, as is shown in excellent specimens in the National Herbarium prepared by Dr. Rose, the formation of the thick trunk follows germination quickly.

## USES.

Though none of the Nolineæ can be considered as of great present economic importance, many of them are utilized in one way or another and it is probable that more use can be made of some species than is now the case. In the great bend of the Rio Grande I have seen the trunks of *Dasyliion* split open to give stock access to the rather watery pith; and they are sometimes cut for feeding.<sup>2,7,23</sup> In Mexico the trunks of *Dasyliion* are roasted and eaten similarly to those of the mezcal agaves; and Dr. Gregg notes a similar use of a *Nolina* on the label accompanying a specimen of it. From such roasted trunks of *Dasyliion*, after fermentation, an alcoholic beverage very similar to mezcal spirits is distilled, and under the name of sotol<sup>12,14,18,21</sup> it is very commonly used through the extensive Mexican territory over which this genus occurs. As in *Yucca*, *Agave*, and some other plants, the sap of those now under consideration contains, as a water conservation provision, a saponifying substance, and the roots of *Nolina Palmeri* are said to serve as an amole.<sup>15</sup> The leaves of *Dasyliion* and *Nolina*—and presumably of *Beaucarnea*—are used for thatching,<sup>18</sup> basket work, coarse hats and similar plaited-ware, either entire or shredded.<sup>8,12,19</sup> Though less employed than that of yuccas and agaves, their fiber is also somewhat used locally, and the narrow leaves of the eastern bear-grass have long been used in their entirety for hanging meat and similar domestic purposes for which strength rather than finished cordage is needed. Some thought seems to have been given also to the preparation of paper pulp from the fiber of *Dasyliion*.<sup>4</sup>

## SYSTEMATIC REVISION.

In revising the forms known to me I have had the privilege of seeing an unusual amount of typical material, for which I am greatly indebted to Professor Radlkofer of Munich (Zuccarini types), Dr. Robinson of Cambridge (Watson types), Dr. Rose of the National Herbarium (types of his own species) and Mr. Brandegee of Berkeley, whose collection contains numerous critical forms. Owing to Engelmann's early interest in the vegetation of the Texano-Mexican region, his herbarium, now at the Missouri Botanical

Garden, is rich in representatives of this, as of other groups characteristic of that arid region,—as herbarium representation of such plants goes: and in it, as well as in the herbarium of the New York Botanical Garden and in the National Herbarium, have been found types or cotypes of the species of Scheele and Torrey.

I do not venture to think that anything like the last word on the group is here said,—the sparse occurrence of the representatives of admitted species through a vast and greatly diversified area, as shown by the distribution map, would speak against such a view; but the following rather tersely cast synopsis is published in the hope that it may render the work of filling gaps in both range and forms easier than it has proved in the past. Space is not taken for a full bibliography,—though this would not have been very extensive; but the principal revisions of each genus are noted, as well as the various names under which a species has appeared; and references are given to all illustrations that have been found.

#### SYNOPSIS OF GENERA.

Ovary 3-celled. Fruit wingless.

Fruit deeply 3-lobed, often inflated: seed nearly globose, rather fleshy-walled. Pedicels articulated rather far below the flowers. Perianth segments entire, papillate-pointed. Leaves strongly ribbed with usually papillate grooves, at most serrulately roughened on the margin. Inflorescence a panicle (or racemosely reduced). *NOLINA.*

Fruit globose-triangular, not lobed or inflated; seed melon-shaped, thin-walled, occluding the sterile cells. Pedicels articulated close to the flowers. Perianth segments nearly entire, rounded. Leaves as in *Nolina*. Inflorescence a panicle. *CALIBANUS.*

Ovary 1-celled. Fruit 3-sided and 3-winged, not lobed or inflated.

Pedicels articulated somewhat below the flowers. Perianth segments entire, acute. Seeds 3-grooved or 3-lobed. Leaves somewhat ribbed, the grooves not usually papillate, at most serrulately roughened on the margin. Inflorescence a panicle. *BEAUCARNEA.*

Pedicels articulated close to the flowers. Perianth segments denticulated, rather obtuse. Seeds 3-grooved or 3-sided. Leaves not ribbed, their margin (in all except one square-leaved species) armed with strong prickles and usually also serrulate-roughened. Inflorescence a stout compound spike. *DASYLIRION.*

#### *NOLINA.*

Michaux, Fl. Bor.-Amer. 1: 208. 1803.—Watson, Proc. Amer. Acad. 14: 246–8. 1879.—Rose, Contr. U. S. Nat. Herb. 10: 92.

1906.—Sometimes merged in *Dasyllirion* or *Beaucarnea*, and made to include the latter genus by Hemsley, Biol. Centr.-Amer. 3: 371, which is conformed to the views of Bentham and Hooker, Gen. Plant. 3: 780.—At first monotypic, based on *N. georgiana*.

Leaves thin and grass-like (but hard-fibrous), linear, rarely over 5 mm. wide, rather flat, usually not brush-like at tip. Bracts not very showy. Acaulescent (pp. 413-416). GRAMINIFOLIÆ.

Inflorescence commonly as long as the minutely serrulate-scabrous essentially green spreading leaves, peduncled, unbranched or with slender usually simple branches 15-25 cm. long. Floriferous bracts small, not imbricated. Pedicels remaining filiform, increasing to 8 or 10 mm. and equaling or exceeding the usually rather large and inflated fruit. Seed not prominently exposed.

Leaves smooth and rather open between the ribs. Panicle not compound. Lower bracts much shorter than the subtended branches. Bractlets barely serrulate.

*NOLINA GEORGIANA* Michaux, Fl. Bor.-Amer. 1: 208. 1803.—  
M(asters), Gard. Chron. n. s. 15: 688, 697. f. 126.

*Phalangium virgatum* Poiret in Lamarck, Encycl. Méth. 5: 246.  
1804.

 Leaves 3-5 mm. wide. Inflorescence simply paniced with rather spreading branches. Flowers rather large. Fruit subelliptical, rather pointed, 7-9 × 8-10 mm. Seed 2 × 4 mm.—*Pl. 5, II.*

Central South Carolina and across central Georgia.

Specimens examined: GEORGIA. Milledgeville (*Boykin*, 1836). Augusta (*Cuthbert*, 1877). Belair (*Eggert*, 1899). Big Lott's Creek (*Harper*, 965, 1901). Columbia County (*Chapman*). Thomson (*Bartlett*, 1174, 1907).

*N. ATOPOCARPA* Bartlett, Rhodora. 11: 81. 1909.

Leaves 2-4 mm. wide. Inflorescence unbranched or simply panicled. Fruit more or less unsymmetrically obovate, shallowly notched, or pointed, scarcely inflated, 5 × 6 mm. Seed 3 × 4 mm.

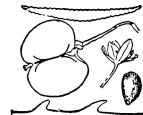
 Eastern Florida.

Specimens examined: FLORIDA. Eau Gallie (*Curtiss*, 5702, 1896,—the type; 2937). Without locality (?*Rugel*, 124, 1842-9; *Chapman*). Tacoi (*Palmer*, 566, 1874; *Garber*, 1876). Tampa Bay (*Burrows*).

Leaves (as in all except the two preceding) with the sides of the ribs microscopically papillate. Lower bracts sometimes about equaling the subtended branches. Bractlets toothed. Fruit (as in all except the two preceding) conspicuously notched.

N. BRITTONIANA Nash, Bull. Torr. Bot. Cl. 22: 158. 1895.

Leaves 5–10 mm. wide. Inflorescence simply panicled with rather erect branches. Fruit depressed-orbicular,  $8 \times 10$  mm. Seed  $3 \times 4$  mm.



North-central Florida.

Specimens examined: FLORIDA. Eustis (Nash, 459, 1894,—the type; Webber, 406, 1896). Clermont (?MacElwee, 1895; Williamson, with the close-ribbed leaves of this species, but fruit rather of *georgiana*).

N. LINDHEIMERIANA Watson, Proc. Amer. Acad. 14: 247. 1879.

*Dasyliion Lindheimerianum* Scheele, Linnæa. 25: 262. 1852.

*D. tenuifolium* Torrey, Bot. Mex. Bound. 215. 1859.

*Beaucarnea Lindheimeriana* Baker, Journ. Bot. 10: 328. 1872.



Leaves 2–5 (exceptionally 9) mm. wide. Inflorescence simply panicled with spreading branches often less than 10 cm. long, or the lower of these with slender branchlets less than half as long. Fruit somewhat depressed-orbicular,  $7-8 \times 8-10$  mm. Seed  $2 \times 3$  mm.—*Pl. 12.*

Central Texas.—In the region of *N. texana* and *Dasyliion texanum*.

Specimens examined: TEXAS. Vicinity of New Braunfels (*Lindheimer*, 213, 1846,—the type of *D. Lindheimerianum*; 551, 552, 1846; 1214–1217, 1849). Sabinal River (*Wright*, 1919, 1851–2, —the type of *D. tenuifolium*). Austin (*Hall*, 634, 1872). Bandera's Pass (*Reverchon*, 1606, 1884). Cherry Spring (*Jermy*, 831). Edwards County (*Hill*, 39, 1895). North of San Antonio (*Hastings*, 87, 1910).—Gillespie County (*Jermy*,—with leaves 4–9 mm. wide). Western Texas (*Wright*, 673, 1849).

Inflorescence rather dwarf, panicled. Bractlets rather conspicuous, more or less lacerate. Leaves glaucescent, raggedly serrulate-scabrous.

Pedicels rather slender, at length equaling or exceeding the fruit.  
Floriferous bracts not imbricated.

Lower bracts linear, leaf-like. Panicle simple.

N. PUMILA Rose, Contr. U. S. Nat. Herb. 10: 92. 1906.



Leaves 2–4 mm. wide. Inflorescence 30 cm. long,  
the upper two-thirds narrowly and simply panicled  
with short weak branches scarcely 2 cm. long.  
Fruit suborbicular, 6–7 mm. in diameter, the pedicels  
somewhat thickened upwards. Seed (immature)  
 $2 \times 3$  mm.

West-central Mexico.

Specimens examined: TEPIC. Sierra Madre Mountains near  
Santa Teresa (Rose, 2165, 1897,—the type).

Lower bracts dilated and scarious. Panicle compound.

N. HARTWEGIANA Hemsley, Biol. Centr.-Amer. 3: 371. 1884.

*Cordyline longifolia* Bentham, Plant. Hartweg. 53. 1840.

*Roulinia longifolia* Brongniart, Ann. Sc. Nat., Bot. ii. 14: 320.  
1840.

*Dasyllirion junceum* Zuccarini, Abhandl. Akad. München. Cl. II.  
4 (=Denkschr. 19): 19. 1845.

*D. Hartwegianum* Zuccarini, l. c. 21. 1845.—Bentham, l. c. 348.  
1857.

*Beaucarnea Hartwegiana* Baker, Journ. Bot. 10: 327. 1872.

Shortly caulescent? Leaves 3–4 mm. wide, somewhat fibrous-shredding at tip. Inflorescence 25–50 cm. long, short-stalked, ovoidly compound-panicled with pyramidal divisions 8–15 cm. long and short stiffish branchlets.—*Pl. 16.*

Central Mexico. Collected about Zacatecas by Hartweg in 1837.

The characters are extracted from the descriptions of Zuccarini and Baker and from a photograph of a Hartweg co-type (406) in the Delessert herbarium which I owe to the obliging kindness of M. de Candolle and reproduce here with his permission.

Pedicels thickened, about half as long as the rather large fruit.  
Floriferous bracts imbricated. Panicle simple, scarcely half as long as the leaves.

N. HUMILIS Watson, Proc. Amer. Acad. 14: 248. 1879.—Hemsley,  
Biol. Centr.-Amer. 5. *pl. 93.*

*Beaucarnea humilis* Baker, Journ. Linn. Soc., Bot. 18: 237. 1880.

Leaves 2–3 mm. wide. Inflorescence 15 cm. long, with a few suberect basal branches one-third as long. Fruit suborbicular,  $7 \times 9$  mm., scarcely inflated. Seed  very large,  $3-4 \times 5$  mm., prominently exposed.

East-central Mexico. In the region of *N. Watsoni*, *Calibanus*, and *Dasyllirion Parryanum* and *graminifolium*.

Specimens examined: SAN LUIS POTOSI. Vicinity of San Luis Potosi (*Parry & Palmer*, 875, 1878,—the type).

N. WATSONI Hemsley, Biol. Centr.-Amer. 3: 372. 1884; 5. pl. 94.

*Beaucarnea Watsoni* Baker, Journ. Linn. Soc., Bot. 18: 236. 1880.

Leaves 5 mm. wide, rather concave and unusually rough-margined.



Inflorescence 25–30 cm. long, with rather numerous strict branches scarcely one-third as long, smooth or somewhat scabrid on the short peduncle. Fruit more or less ovate-orbicular, cordately notched,  $8 \times 8-10$  mm., inflated. Seed (immature)  $2 \times 3$  mm.

East-central Mexico. In the region of *N. humilis*, etc.

Specimens examined: SAN LUIS POTOSI. Vicinity of San Luis Potosi (*Parry & Palmer*, 874, 1878,—the type, 502, 1878; *Schaffner*, 261, 1879).

Leaves rather thick, linear or narrowly oblong-triangular, scarcely over 12 mm. wide, green, more or less concave and unequally keeled on one or both faces, raggedly dentate-scabrous in most species and in age often fibrous-lacerate at tip. Inflorescence usually about as long as the leaves, peduncled, compound-panicked. Bracts not usually very showy. Bractlets more or less lacerate.

Fruit small, not inflated, the relatively large seed early exposed and prominent (pp. 416–420). ERUMPENTES.

Inflorescence (as in the last preceding species) often roughened in lines. Pedicels rather thickened in fruit. Acaulescent.

Lower bracts firmly long-attenuate from a somewhat dilated scarious-margined base.

Lower panicle divisions much shorter than the subtending bracts, with rather weak strongly ascending branchlets.

N. TEXANA Watson, Proc. Amer. Acad. 14: 248. 1879.—Nash,  
Journ. N. Y. Bot. Gard. 6: 48. f. 16.

*Beaucarnea texana* Baker, Journ. Linn. Soc., Bot. 18: 236. 1880.

Leaves very narrow, 2–5 mm. wide, smooth-edged or slightly roughened, from half-round becoming triquetrous. Inflorescence often much shorter than the leaves, with oblong divisions often 15 cm. long and lower branchlets half as long, or subsimple. Fruit somewhat depressed,  $4 \times 5\text{--}6$  mm. Seed 3 mm. in diameter.—*Pl. 12, 15.*

Central Texas. In the region of *N. Lindheimeriana* and *Dasylirion texanum*.

Specimens examined: TEXAS. Vicinity of New Braunfels (*Lindheimer*, 550, 1846, 712, 1847,—the types; 1218, 1849). Austin (*Hall*, 635, 1872). Hamilton County (*Reverchon*, 967, 1882). Cibolo (*Havard*, 1883). Blanco County (*Reverchon*, mixed with 1606). Kerr County (*Bray*, 184, 1899). Davis Mountains (*Earle & Tracy*, 322, 1902). Gillespie County (*Jermy*, 327). Comstock (*Thompson*, 1911). Without locality (*Buckley*).

Lower bracts mostly triangular, becoming friable.

Lowest panicle division much shorter than the long-caudate subtending bract, with rather weak finally ascending branchlets.

#### *N. affinis* Trelease.

Leaves very narrow, 3–4 mm. wide, sometimes smooth-edged. Inflorescence at length with broad divisions 10 cm. long and lower branchlets scarcely half as long. Fruit depressed,  $5 \times 6\text{--}7$  mm. Seed 3 mm. in diameter.



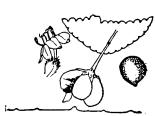
North-central Mexico. On the outskirts of the range of *N. erumpens*, *N. microcarpa* and *Dasylirion leiophyllum*.

Specimens examined: CHIHUAHUA. Rocky hills near Chihuahua (*Pringle*, 1, 2, 1885,—the type). Santa Eulalia (*Palmer*, 139, 1908; *Rose*, 11672, 1908).

#### *N. caudata* Trelease.

?*Nolina* sp. *Rose*, Contr. U. S. Nat. Herb. 20. pl. 46–8.

Leaves very narrow, 4 mm. wide, somewhat rough-edged. Inflorescence slender, with narrow divisions scarcely 10 cm. long and lower branchlets 2–5 cm. long. Fruit rather depressed,  $4 \times 5\text{--}6$  mm. Seed 3 mm. in diameter.—*Pl. 6.*



Southern Arizona. In the region of *N. microcarpa* and *Dasylirion Wheeleri*.

Specimens examined: ARIZONA. Mule Mountains (*Toumey*, 1894,—the type). Huachuca Mountains (?*Wilcox*, 1892, and 257, 1894; *Griffiths*, 4831, 1903). Dragoon Summit (?*Vasey*, 1881,—leaves). Nogales (?*Brandegee*, 1892; *Ferriss*, 1902; *Coville*, 1624, 1903; *Thompson*, 1911). Sierra del Pajarito (?*Trelease*, 387, 1900). BOUNDARY LINE (?*Parry*, *Bigelow*, *Wright & Schott*, 1443; *Mearns*, 258, 290, 1892).

Lower panicle divisions more or less equaling the attenuate subtending bracts, with rather stiff spreading branchlets.

*N. ERUMPENS* Watson, Proc. Amer. Acad. 14: 248. 1879.

*Dasylirion erumpens* Torrey, Bot. Mex. Bound. 216. 1859.

*Beaucarnea erumpens* Baker, Journ. Bot. 10: 326. 1872.

Leaves usually 6–10 mm. wide and very rough-edged, exceptionally narrower or smooth-edged. Inflorescence with pyramidal divisions 15 cm. long and lower branchlets half as long. Fruit rather depressed,  $5 \times 5\text{--}7$  mm. Seed very large, 4 mm. in diameter.



Western Texas and adjacent Mexico. In the region of *Dasylirion leiophyllum* and *D. Wheeleri Wislizeni*.

Specimens examined: TEXAS. Western Texas (*Wright*, 1918, 1851–2,—the type of *D. erumpens*; 692, 1849). Chisos Mountains (*Bailey*, 391, 1901). Eagle Mountain (*Bigelow*, 1852). Eagle Spring (*Hayes*, 1858). Podrero (?*Schott*, 1855). CHIHUAHUA. Between El Paso and Chihuahua (*Wislizenus*, 219, 1846).

***N. erumpens compacta* Trelease.**

Leaves almost as in *texana*, sometimes scarcely 5 mm. wide, the edge either rough or smooth. Inflorescence with very compact ovoid divisions scarcely 6 cm. long and branchlets about 1 cm. long.

Extreme western Texas.

Specimens examined: TEXAS. El Paso (*Ferriss*, 1902,—the type). Sierra Blanca (*Trelease*, 386, 1900). Sanderson (?*Thompson*, 1911). Marathon (*Lloyd*, 1910). Presidio (*Havard*, 1880).

***N. GREENEI* Watson in herb.** Greene, Bot. Gaz. 5: 56. 1880.—Name only.



Leaves 6–7 mm. wide, smooth-edged. Inflorescence with rather narrow divisions scarcely 10 cm. long and lower branchlets nearly half as long. Fruit depressed,  $4 \times 6$  mm. Seed  $2 \times 3$  mm.

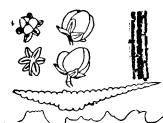
Southeastern Colorado to northeastern New Mexico. The northernmost species of the group.

Specimens examined: COLORADO. Between the Purgatory and Apishapa rivers, north of Trinidad (*Greene*, Jan., 1880,—the type). NEW MEXICO. San Miguel County (*Brandegee*, 1879). Lincoln County (*Wooton*, 656, 1897).

Lower panicle divisions considerably shorter than the subtending bracts, with short stiff spreading branchlets.

#### **N. cespitifera** Trelease.

Leaves 6–10 mm. wide, with dorsal as well as marginal roughening. Inflorescence very rough from compound tussocks, with narrow divisions 10 cm. long and lower branchlets scarcely one-third as long. Fruit nearly orbicular, about 5 mm. in diameter. Seed?



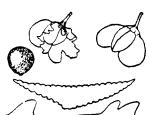
North-central Mexico. On the margin of the range of *Dasylirion cedrosanum*.

Specimens examined: COAHUILA. Battlefield of Buena Vista (*Wislizenus*, 308, 1847,—the type). High dry lands near Saltillo (*Gregg*, 81, 1847).

Inflorescence (as usual in the genus) essentially smooth. Lower bracts triangular, scarcely equaling the panicle divisions. Pedicels slender. Acaulescent with one exception.

#### **N. PALMERI** Watson, Proc. Amer. Acad. 14: 248. 1879.

*Beaucarnea Palmeri* Baker, Journ. Linn. Soc., Bot. 18: 235. 1880.



Leaves 8–10 mm. wide, serrulate-scabrous. Inflorescence with narrow divisions 15 cm. long and rather stiff ascending lower branchlets scarcely one fourth as long. Fruit depressed,  $4 \times 5$  mm. Seed 3 mm. in diameter.

Lower California. Overlapping the region of *N. Bigelovii* and

*N. Beldingi deserticola*.—The type locality is given as Tantillas Mountains.

Specimens examined: LOWER CALIFORNIA. Piñon district (*Orcutt*, 713, 1882,—determined by Mr. Watson). San Pedro Martir (*Brandegee*, 1893). Paraiso (?*Brandegee*, 1890).

### **N. Palmeri Brandegeei** Trelease.

*Nolina* sp. *Brandegee*, Proc. Cal. Acad. ii. 2: 209. 1889.

?*N. Palmeri* *Brandegee*, Zoe. 1: 306.

Arborescent. Trunk about 5 m. high, at length few-branched above. Leaves 7–8 cm. wide, rather glossy, denticulate-scabrous. Inflorescence with divisions 15 cm. long and lower branchlets about one-third as long.

Lower California.

Specimens examined: LOWER CALIFORNIA. San Julio (*Brandegee*, Apr. 11, 1890,—the type). Northern Lower California (*Orcutt*, July 3, 1885).

Fruit moderate in size, somewhat inflated, the relatively small seed not protruding if early exposed. Panicle divisions with rather weak mostly elongated and ascending branchlets (pp. 420–422). **MICROCARPÆ.**

Lower panicle divisions more or less equaling the friable triangular bracts. Acaulescent. Leaves elongated.

**N. MICROCARPA** Watson, Proc. Amer. Acad. 14: 247. 1879.

*Beaucarnea microcarpa* Baker, Journ. Linn. Soc., Bot. 18: 236. 1880.

Leaves 6–12 mm. wide, raggedly denticulate-scabrous. Inflorescence with often broad divisions 15–30 to even 45 cm. long, and lower branchlets—sometimes again branched at base—half as long or less. Fruit nearly as long as the pedicels, depressed,  $5 \times 7$ –8 mm. Seed 3 mm. in diameter, attached and exposed after dehiscence of fruit.—*Pl. I, 12.*



Southeastern Arizona and adjacent New Mexico and Mexico. Overlapping the region of *N. caudata* and associated with *Dasylirion Wheeleri*. The type locality is Rock Cañon, Arizona.

Specimens examined: ARIZONA. Rocky Cañon (*Rothrock*, 278, 1874). Chiricahua Mountains (*Toumey*, 1894; *Blumer*, 1316, 1906).

Santa Catalina Mountains (*Pringle*, 1881, 1882, 1884). Santa Rita Mountains (*Pringle*, 1882; *Brandegee*, 1891). Without locality (*Toumey*, 447, 1892). Sun Flower Valley (*Girard*, 1, 1873). Blue River (*Davidson*, 775, 1902). NEW MEXICO. Santa Rita del Cobre (*Greene*, 1880). Burro Mountains (*Rusby*, 413, 1881,—fruit; *Goldman*, 1530, 1908). Dog Mountains (*Mearns*, 294, 1892). Lone Mountain (*Mulford*, 427, 429, 1895). Otero County (*Rehn & Viereck*, 1902). Round Mountain (?*Wooton*, 1905,—very narrow-leaved, as in *texana*). Mogollon Mountains (*Rusby*, 412, 1881; *Metcalfe*, 232, 1903). Mimbres River (*Metcalfe*, 1025, 1904). San Luis Pass (*Mearns*, 186, 1892; *Wooton*, 1906). Twin Sisters (?*Blumer*, 1905). Silver City (?*Bailey*, 1906). Big Hatchet Mountains (*Goldman*, 1341, 1908). BOUNDARY LINE (*Parry*, *Bigelow*, *Wright & Schott*, 1442). CHIHUAHUA. Colonia Garcia (*Townsend & Barber*, 76, 1899). Vicinity of Chihuahua (?*Pringle*, 159, 1885; *Palmer*, 355, 1908).

#### N. durangensis Trelease.



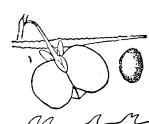
Leaves very thin, 7–11 or even 20 mm. wide, irregularly serrulate-scabrous. Inflorescence with broad divisions at length 15–20 cm. long and chiefly basal branchlets 10–12 cm. long. Fruit usually considerably shorter than the rather slender pedicels, more or less depressed, small, 5–6 × 6–7 mm. Seed 3 mm. in diameter.—*Pl. 10.*

Northwestern Mexico. In the region of *Dasyllirion durangense* and *simplex*.

Specimens examined: DURANGO. Vicinity of Durango (*Palmer*, 249, 1896,—the type; *Ochoterena*, 1911; *Patoni*, 1911). Tepehuanes (*Palmer*, 329, 1906). CHIHUAHUA. Southwestern Chihuahua (?*Endlich*, 1162a, 1162b, 1906).

N. ELEGANS Rose, Contr. U. S. Nat. Herb. 10: 91. f. 6. 1906.

Leaves very thin, 12 mm wide, sometimes lanceately narrowed above the base, serrulate-scabrous. Inflorescence with broad divisions 10–15 cm. long and rather few branchlets scarcely half as long. Fruit about equaling the pedicels, rather large, 7 × 8–10 mm. Seed 3 × 4 mm.



Central Mexico. In the region of *N. Hartwegiana*?

Specimens examined: ZACATECAS. Sierra Madre Mountains (*Rose*, 2396, 1897,—the type).

Lower panicle divisions considerably longer than the triangular bracts. Shortly caulescent. Leaves much shorter than the inflorescence.

***N. rigida* Trelease.**

*Anatis rigida* Brongniart, Ann. Sc. Nat., Bot. ii. 14: 320. 1840.

Leaves 4–5 mm., scarcely 10 cm. long, ciliate-scabrous. Inflorescence much surpassing the leaves, sessile, with broad divisions about 10 cm. long and rather few branchlets scarcely half as long. Fruit about equaling the slender pedicels, moderate, about 6 mm. in diameter. Seed 2 mm. in diameter.—*Pl. 17*.

Mexico? Known only from the unpublished figures of Sese and Moçiño and Node-véran, which M. de Candolle has placed in my hands for study, and of which he has furnished for publication an excellent photographic copy.

Leaves relatively or actually thin, 15–40 mm. wide, serrulate-scabrous, not usually brush-like at tip. Inflorescence ample, often peduncled, compound-panicked or occasionally decompound. Bracts usually dilated and papery, often showy. Bractlets fimbriate-lacerate, conspicuous. Fruit large, inflated, the seed not protruded. Trees (with one exception?) (pp. 422–426). ARBORESCENTES.

Leaves rather thick, little shredded at tip. Pedicels scarcely half as long as the fruit.

***N. PARRYI* Watson, Proc. Amer. Acad. 14: 247. 1879.**

Trunk 1–2 m. high. Leaves almost pungent, rather thick, concave, keeled, 15–25 or even 35 mm. wide, serrulate-scabrous. Inflorescence with rather narrow divisions 15–30 cm. long and spreading densely flowered branchlets scarcely 4 cm. long. Flowers large, with perianth segments 4 mm. long. Fruit very large, orbicular, deeply notched at both ends, 12–15 mm. in diameter. Seed 3 × 4 mm.—*Pl. 5, 12*.

Colorado desert. In the region with *N. Bigelovii*.

Specimens examined: CALIFORNIA. Desert east of San Bernardino (*Parry*, 1876,—the type). Whitewater (*Vasey*, 1881,—



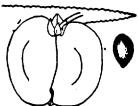
leaf). San Gorgonio Pass (*Engelmann*, 1880). San Bernardino Mountains (*Parish*, 1879: 910, 1882; 3145, 3165, 1894). San Felipe (*Brandegee*, 1894). Pala (*Orcutt*). San Jacinto Mountains (*Hall*, 1819, 2432, 1901). ARIZONA. Fort Whipple (*Coues & Palmer*, 1865). Between Sandy and Bill Williams Forks (*Mrs. Stephens*, 1902).

N. BIGELOVII Watson, Proc. Amer. Acad. 14: 247. 1879.

*Dasyllirion Bigelovii* Torrey, Bot. Whipple. 151. 1857; Bot. Mex. Bound. 216. 1859.

*Beaucarnea Bigelovii* Baker, Journ. Bot. 10: 326. 1872.

Trunk 1-2 m. high. Leaves almost pungent, scarcely concave or keeled, 15-25 mm. wide, often roughened on the surface, the at first rough margin shredding away in brown fibers. Inflorescence with rather narrow divisions 15-30 cm. long and branchlets scarcely 4 cm. long. Perianth segments about 3 mm. long. Fruit large, orbicular, deeply notched at both ends, usually 10-12 mm. but occasionally 15 mm. in diameter. Seed  $3 \times 4$  mm.



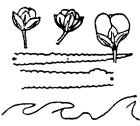
Western Arizona, across the Colorado desert, and into Lower California. In the region of *N. Parryi* and overlapping the ranges of *N. Palmeri* and *N. Beldingi*. A sketchy picture of it, in the Tinajas Altas, is given by Schott in Emory, Rept. Bound. Surv. 1. pl. 59.

Specimens examined: ARIZONA. Bill Williams Fork (*Bigelow*, 1853-4,—the type of *D. Bigelovii*). Union Pass (*Palmer*, 1870). Havasupai Cañon (*Kinner*, 1900). Gold Road (*Mrs. Stephens*, 1902). Little Meadows (*Mrs. Stephens*, 1902). CALIFORNIA. Mountain Springs, near the boundary (*Parish*, 1880; *Vasey*, 1880; *Mearns*, 2980, 3015, 3066, 3146, 1894). LOWER CALIFORNIA. Cantillas Cañon (*Orcutt*, July 8, 1884). Yubay (*Brandegee*, 1889).—BOUNDARY LINE. Tule (*Mearns*, 320, 1894).—SONORA. (?*Schott*, 1441,—with fruit scarcely 8 mm. in diameter.)

Leaves rather thin, sometimes shredded at tip. Pedicels nearly or quite equaling the fruit.

*N. NELSONI* Rose, Contr. U. S. Nat. Herb. 10: 92. 1906.

Trunk 1–3 m. high. Leaves 30–40 mm. wide, strongly serrulate-scabrous. Inflorescence with narrow ascending divisions 15 cm. long, and branchlets —chiefly upwards—scarcely half as long. Fruit?



Northeastern Mexico. In the region of *Dasyllirion longissimum*.

Specimens examined: TAMAULIPAS. Mountains near Miquihuana (Nelson, 4489, 1898,—the type).

*N. BELDINGI* Brandegee, Zoe. 1: 305. 1890.

*N. Beldingii* Brandegee in Bailey, Cycl. Amer. Hort. 3: 1092. 1901; Gard. Chron. iii. 34: 43. f. 18. 1903.

Trunk 3–5 m. high, rather openly branched. Leaves very slightly glaucous, 15–20 mm. wide. Inflorescence long-peduncled, narrow, with narrow divisions 50 cm. long and branches 8–10 cm. long, often again branched with branchlets 1–2 cm. long. Fruit much depressed, retuse at base, very large, 8–10 × 15 mm. or more.

Seed large, 4 × 5 mm.

Lower California. The type locality is mountain tops in the Cape Region.

Specimens examined: LOWER CALIFORNIA. Sierra de San Francisco (Brandegee, 583, 1892). La Chuparosa (Brandegee, 1893, 1905).

#### ***N. Beldingi deserticola* Trelease.**

Subacaulescent with leaves scarcely 50 cm. long, otherwise resembling the type.

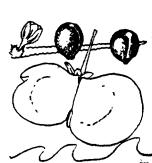
Lower California. In the desert association of *N. Palmeri* and *N. Bigelovii*.

Specimens examined: LOWER CALIFORNIA. Yubay (Brandegee, 1889,—the type).

*N. PARVIFLORA* Hemsley, Biol. Centr.-Amer. 3: 372. 1884.

*Cordyline parviflora* HBK., Nov. Gen. Sp. 1: 268. 1815; 7. pl. 674. 1825.

*Dracæna parviflora* Willdenow in Schultes, Syst. 7: 348. 1829.



*Roulinia Humboldtiana* Brongniart, Ann. Sci. Nat., Bot. ii. 14: 320. 1840.

*Dasyliurium Humboldtii* Kunth, Enum. 5: 42. 1850.

*Nolina Altamiranoa* Rose, Proc. U. S. Nat. Mus. 29: 438. 1905.

?*Beaucarnea recurvata stricta* Baker, Journ. Linn. Soc., Bot. 18: 234. 1880.—As to localities cited.



Trunk 2–4 m. high. Leaves 15–20 or 25 mm. wide. Inflorescence with divisions 25 cm. long and lower branchlets half as long. Bracts very showy, nearly 50 cm. long, caudate-attenuate. Fruit very large, 8–10–12 × 14 mm. Seed 3 × 4 mm.

South-central Mexico. The type locality is between Hauhtitlan and Tanepantla.

Specimens examined: FEDERAL DISTRICT. Above Santa Fe (Pringle, 8060, 1899,—the type of *N. Altamiranoa*; 13620, 1905; Rose & Hay, 5388, 1901; Rose & Painter, 8659, 1905). Rio Hondo Cañon (Pringle, 6787, 1898). Chalchicomula (J. G. Smith, 451, 1892). Guadalupe (Bourgeau, 520, 1865–6). PUEBLA. Esperanza (Purpus, 821, 1907). VERA CRUZ. Limon (?Trelease, 80, 1905).

N. LONGIFOLIA Hemsley, Biol. Centr.-Amer. 3: 373. 1884.

*Yucca longifolia* Schultes, Syst. 7: 1715. 1830.—Zuccarini, Allgem. Gartenzeit. 6: 258.

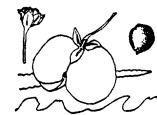
*Dasyliurion longifolium* Zuccarini, Abhandl. Akad. München. Cl. II. 3 (=Denkschr. 16) : 224. pl. 1. f. 2. 1840; 4 (=Denkschr. 19) : 20, 21.—Morren, Belg. Hort. 1865: 321. pl. 20.—Garden. 11: 291. f.—Gard. Chron. n. s. 7: 493. f. 73, 567. f. 90.—Fenzi, Bull. Soc. Ort. Tosc. 1890: 112. pl. 6.—Rehnelt, Gartenwelt. 11: 14. f.—Urban, Gart. Zeit. 3: 66. f. 20.—Die Natur. 34: 340. f.—Murison, Garden. 24: 433. f.—Gartenflora. 29: 117. f.; 33: 68. f.—Roezl, Belg. Hort. 33: 139.—Gérome, Rev. Hort. 83: 206. f. 82.

*Roulinia Karwinskiana* Brongniart, Ann. Sc. Nat., Bot. ii. 14: 320. 1840.

?*Yucca Barrancasecca* Pasquale, Cat. R. Ort. Bot. Napoli. 108. 1867.—See also Zuccarini, l. c., and Rept. Mo. Bot. Gard. 13: 114.

*Beaucarnea longifolia* Baker, Journ. Bot. 10: 324. 1872.

Trunk 2-3 m. high, swollen at base, at length closely few-branched at top. Leaves 20-30 mm. wide, very long and recurving over the trunk; green. Inflorescence nearly sessile with divisions 30 cm. long and lower branchlets scarcely one-fifth as long. Fruit sub-orbicular or rather depressed, large, 8 × 10-12 mm. Seed 3 × 4 mm.—*Pl. 3, 8, 13.*



South-central Mexico. In the region of *Dasyliion serratifolium*. The type locality is given as San Jose del Oro by Schultes, on authority of Karwinski. Roezl gives its occurrence at about 3,000 m. altitude in Puebla, Oaxaca and Mexico.

Specimens examined: OAXACA. Huachilla (*Conzatti*). PUEBLA. Esperanza (*Purpus*, 5077, A, ?5076, ?5078). San Luis Tultitlanapa (*Purpus*, 432, 1907, 5079, B, 1908). CULTIVATED. Munich Botanical Garden, from Karwinski's seed (*Radlkofler*, 1901,—semi-typical). Palermo Botanical Garden (*Trelease*, 1, 1905). Bushey House Gardens (*Blake*, 1909).

Certain questionable thin- but narrow-leaved forms grown in gardens under this name, or, in a glaucous form, as var. *glaucra* or as *Pincenectitia glauca*, appear to be forms of *Beaucarnea*.

#### CALIBANUS.

Rose, Contr. U. S. Nat. Herb. 10: 90. 1906.—Monotypic, based on the species figured by Hooker for *Dasylium Hartwegianum*.

#### **Calibanus Hookerii** Trelease.

*Dasylium Hartwegianum* Hooker, Bot. Mag. iii. 15. pl. 5099. 1859.

*D. Hookerii* Lemaire, Ill. Hort. 6. misc. p. 24. 1859.

*D. caespitosum* Scheidweiler, Wochenschr. Verein Beförd. Gartenbau. 4: 286. 1861.

*D. Hookeri* Lemaire, Ill. Hort. 12. misc. p. 52. 1865.

?*D. flexile* Koch, Ind. Sem. Berol. 1867. Append. 1: 5.

*Beaucarnea Hookeri* Baker, Journ. Bot. 10: 327. 1872.

*Calibanus caespitosus* Rose, Contr. U. S. Nat. Herb. 10: 90. f. 4. pl. 24-5. 1906.

Shortly caulescent. Trunk depressed globose with numerous crowns of leaves. Leaves rather thin, somewhat concave and keeled, narrowly linear, 2–3 mm. wide, serrulate-scabrous on the margin, not brush-like at tip, blue. Inflorescence scarcely 25 cm. long, shorter than the leaves, very short-peduncled, simply panicled with thin spreading branches 6–8 cm. long, or with exceptional very short and few basal branchlets. Bracts scarious, much shorter than the subtended branches, the floriferous ones and the bractlets inconspicuous, ovate or lanceolate, little-toothed. Flowers minute. Perianth segments about 1 mm. long. Fruit triquetrously subglobose, 3-ribbed, 4–5 × 5–7 mm. Seed melon-shaped, 3 × 3–4 mm.—*Pl. 6, 8, 9, 11, 14.*



East-central Mexico. The type locality is Real del Monte.

Specimens examined: HIDALGO. Ixmiquilpan (*Rose, Painter & Rose*, 8954, 1905; *Purpus*, 1200, 4775, 1905). SAN LUIS POTOSI. San Luis Potosi (*Orcutt*, 1903; *Palmer*, 1905).

#### BEAUCARNEA.

Lemaire, Ill. Hort. 8. misc. p. 57, with plate. 1861.—Baker, Journ. Bot. 10: 323. 1872; Journ. Linn. Soc., Bot. 18: 233. 1880,—in both cases including *Nolina*.—Rose, Contr. U. S. Nat. Herb. 10: 87. 1906.—Though not monotypic, based primarily on *B. recurvata*, and capable of precise definition.

Leaves with essentially smooth grooves and nearly smooth margins, thin, nearly flat, recurved, green. Floriferous bracts rather elongated. Fruit large, rather long-stalked before falling. Slender trees, about 10 m. high, moderately enlarged at base.

#### EUBEACARNEA.

BEACARNEA RECURVATA Lemaire, Ill. Hort. 8. misc. p. 61. 1 pl. 1861.—Gard. Chron. 1870: 1445. f. 254; iii. 46: 4. f. 3.—Deutsch. Gart. Mag. 1871: 288. pl.—Gartenflora. 28: 210. f.—Croucher, Garden. 19: 372. f.

*Pincenectitia tuberculata* Lemaire, l. c., as synonym.

*Beaucarnea tuberculata* Roezl, Belg. Hort. 33: 138. 1883.

*Nolina recurvata* Hemsley, Biol. Centr.-Amer. 3: 372. 1884.—

Rehnelt, Gartenwelt. 11: 78. f.—Gard. & Forest. 9: 94. f.—

Fl. des Serres. 18. misc. p. 26. f.—Karsten & Schenck, Vegetationsbilder. 1. pl. 34.—Gérôme, Rev. Hort. 83: 207. f. 83.

*N. tuberculata* Hort.

Trunk openly slender-branched above. Leaves 15–20 mm. wide, 1.5–2 m. long. Inflorescence nearly sessile, broadly ovoid-panicked, decompound with divisions 30 cm. long, lower branches nearly half as long and branchlets 5 cm. long. Perianth segments 3 mm. long. Fruit?

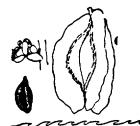
Southeastern Mexico. Noted by Roezl at Paso del Macho and by Karsten at Sta. Maria, in the State of Vera Cruz.—The type of the genus.—Two garden varieties, *intermedia* and *rubra*, are noted by Baker, Journ. Linn. Soc., Bot. 18: 234. 1880.

Specimens examined: CULTIVATED. Palermo Botanical Garden (*Trelease*, 1905). Missouri Botanical Garden.

B. INERMIS Rose, Contr. U. S. Nat. Herb. 10: 88. f. 2. 1906.

*Dasyliion inerme* Watson, Proc. Amer. Acad. 26: 157. 1891.

Trunk rather closely few-branched at top. Leaves 12–15 mm. wide, about 1 m. long. Inflorescence long-stalked, narrowly pyramidal-panicked, somewhat decompound with divisions 30 cm. long, slender lower branches half as long and few branchlets 3–4 cm. long. Perianth segments scarcely 2 mm. long. Fruit elongated-elliptical, 10 × 14 mm. Seed (immature) 2 × 3 mm.



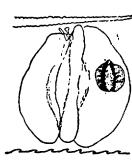
East-central Mexico.

Specimens examined: SAN LUIS POTOSI. Las Palmas (*Pringle*, 3108, 1890,—the type of *Dasyliion inerme*). San Dieguito (*Palmer*, 644, 1905). VERA CRUZ. Zazuapam (?*Purpus*, 4432, 1907). East of Huatusco (?*Endlich*, 1162, 1906). Carrizal (?*Goldman*, 708, 1901).—The incomplete Vera Cruz material perhaps belongs to the preceding, though short-leaved.

B. PLIABILIS Rose, Contr. U. S. Nat. Herb. 10: 89. 1906.

*Dasyliion pliable* Baker, Journ. Linn. Soc., Bot. 18: 240. 1880.

Trunk openly slender-branched at top. Leaves 15 mm. wide, less than 1 m. long. Inflorescence compound-panicked with broad divisions 30 cm. long and few rather short spreading branches. Perianth segments 3 mm. long. Fruit somewhat obovately round-elliptical, 11–12 × 13–15 mm. Seed 3 × 4 mm., irregularly 3-lobed, transversely wrinkled.—*Pl. 10.*

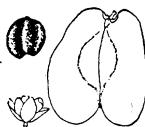


Southeastern Mexico.

Specimens examined: YUCATAN. Near Sisal (*Schott*, 892,—the type of *Dasyllirion pliabile*). Progreso (*Goldman*, 607, 1901).

B. GUATEMALENSIS Rose, Contr. U. S. Nat. Herb. 10: 88. f. 1. 1906.

Trunk often with slender multiple stems, variously branched.



Leaves 25–30 mm. wide, less than 1 m. long, smooth-edged. Inflorescence short-stalked, broadly ovoid-panicked, decompound with divisions 30 cm. long, rather spreading branches sometimes half as long, and few branchlets 6 cm. long. Perianth segments 3 mm. long. Fruit elliptical-obovate, 13–15 × 15–18 mm., at length openly notched at top and base. Seed 5 mm. in diameter, irregularly 3-lobed, smooth.—*Pl. 7.*

Guatemala. The southernmost species of the group.

Specimens examined: GUATEMALA. El Rancho (*Kellerman*, 4320, 1905,—the type; 5398, 1906; 7015, 1907, and 7029, 1908). CULTIVATED. Guatemala City (*Kellerman*, 6069, 1907).

B. GOLDMANII Rose, Contr. U. S. Nat. Herb. 12: 261. *pl. 20.* 1909.

Trunk openly slender-branched above. Leaves 15 mm. wide, scarcely 1 m. long, essentially smooth-edged. Inflorescence nearly sessile, compound-panicked with narrow ascending divisions 15–20 cm. long and few strict branches about half as long. Perianth segments about 2 mm. long. Fruit elliptical, very large, 12–15 × 18–20 mm. Seed?

Southern Mexico.

Specimens examined: CHIAPAS. San Vicente (*Goldman*, 887, 1904,—the type).

Leaves papillate-grooved as in *Nolina*, rather rough-margined, firm, more or less concave, keeled or plicate, nearly straight, pale or glaucous. Florigerous bracts short. Fruit small for the genus, very short-stalked. Trees about 10 m. high, greatly swollen at base.

PAPILLATÆ.

B. STRICTA Lemaire, Ill. Hort. 8. misc. p. 61. 1861.

*Pincenectitia glauca* Lemaire, l. c., as synonym.

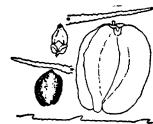


*Beaucarnea recurvata stricta* Baker, Journ. Linn. Soc., Bot. 18: 234. 1880.

*B. glauca* Roezl, Belg. Hort. 33: 138. 1883.

*B. Purpusi* Rose, Contr. U. S. Nat. Herb. 10: 89. 1906.—  
Purpus, Möller's Deutsch. Gärtner-Zeit. 23: 223. f.

Trunk moderately swollen, irregularly rather few-branched. Leaves more or less keeled or plicate, 8–15 mm. wide, scarcely 1 m. long, the yellowish margin usually minutely serrulate-scabrous. Inflorescence short-stalked, ovoid-panicled, decompound with narrow divisions 20 cm. long and short branches, the lower with branchlets 3 cm. long. Perianth segments 2 mm. long. Fruit broadly elliptical, 8–10 × 12 mm. Seed 3 × 4–5 mm. irregularly 3-lobed, smooth.—*Pl. 8, 14.*



South-central Mexico. Associated with the next and *Dasylirion lucidum*.

Specimens examined: PUEBLA. Tehuacan (*Rose, Painter & Rose*, 10156, 1905,—the type of *B. Purpusi*; *Rose & Rose*, 11220, 1906; *Purpus*, 2397, 1907). San Luis Tultitlanapa (*Purpus*, 5080, 1908). OAXACA. Tomellin Cañon (*Rose & Rose*, 11427a and b, 1906). Almoloyas to Sta. Catarina (?*Conzatti*, 1644, 1906).

*B. GRACILIS* Lemaire, Ill. Hort. 8. misc. p. 61. 1861.

*B. ædipus* Rose, Contr. U. S. Nat. Herb. 10: 88. pl. 23. 1906.—  
MacDougal, Publ. Carnegie Inst. 99. pl. 19.

?*Nolina histrix* Hort.

Trunk enormously swollen below, variously and irregularly branched. Leaves very glaucous, 4–7 mm. wide, scarcely 50 cm. long, minutely but sharply serrulate-scabrous on the paler margin. Inflorescence short-stalked, ovoid- or oblong-panicled, decompound with divisions scarcely 30 cm. long and weak branches half as long, the lower often similarly branched. Perianth segments scarcely 2 mm. long. Fruit round-elliptical, 7–9 × 10 mm. Seed 2 × 3 mm., smooth.—*Pl. 4, 11.*



South-central Mexico. Associated with the preceding.

Specimens examined: PUEBLA. Tehuacan (*Rose, Painter &*

*Rose*, 10157, 1905,—the type of *B. oedipus*; *Trelease*, 1, 1903; *Purpus*, 1253a in part, 1905, and 2503, 1907). CULTIVATED. New York Botanical Garden (*Taylor*, 25734, 1906).

### DASYLIRION.

Zuccarini, Allgem. Gartenzeit. 6: 258, 303. 1838.—Plant. Nov. vel Minus Cognit. 4: 221. pl. 1 (Abhandl. Akad. München. Cl. II. 3. = Denkschr. 16). 1840;—Plant. Nov. etc. 5: 19. (Abhandl. Akad. München. Cl. II. 4. = Denkschr. 19). 1845.—Kunth, Enum. Plant. 5: 38. 1850,—as *Dasylium*.—Baker, Journ. Bot. 10: 296. 1872; Journ. Linn. Soc., Bot. 18: 237. 1880.—Rose, Contr. U. S. Nat. Herb. 10: 89. 1906.—Though primarily based on *Yucca pitcairniaefolia* (*Hechtia glomerata*) and made to include with question *Yucca* [*Nolina*] *longifolia*, it finally stood with its author for the prickly-leaved sotols, of which *D. serratifolium* and *D. graminifolium* were definitely included in his first publication on the genus and mark its type.

Leaves 2-edged, usually somewhat concave and irregularly keeled, prickly-margined and usually roughened with minute intervening denticles or serratures (pp. 431–440).

#### EUDASYLIRION.

Fruit small (3–5 mm. wide).

Fruit normally with moderately deep notch, narrowly elliptical to obovate, the style not surpassing the wings. Perianth segments about 2 mm. long. Leaves elongated, rather wide (usually 15–20 mm.).

Prickles prevailingly upcurved.

#### *Dasyliion cedrosanum* Trelease.

*Dasyliion* sp. Kirkwood, Pop. Sci. Monthly. 75: 438, 445. f.

Shortly caulescent. Trunk 1–1.5 m. high. Leaves 20 mm. wide,



upwards of 1 m. long, slightly brush-tipped, glaucous, slightly rough-keeled, dull; prickles mostly 10–15 mm. apart, 2–5 mm. long, yellow, becoming red upwards. Inflorescence 5 m. high. Fruit very narrowly elliptical, 4–5 × 7–9 mm., the style barely half as long as the narrow deep notch. Seed 2 × 3.5 mm. Pl. 5, 12, 15.

Northeastern Mexico. Overlapping the range of *Nolina cespitifera*.

Specimens examined: ZACATECAS. Cedros (*Lloyd*, 118,—the type, and 82, 1908; *Kirkwood*, 96, 1908). COAHUILA. Rancho La Luz (?*Endlich*, 7, 1905). Saltillo (?*Gregg*, 78, 1846). Angostura (?*Wislizenus*, 307, 1847).

**D. LUCIDUM** Rose, Contr. U. S. Nat. Herb. 10: 90. 1906.

*Dasylyrion* sp. Schenck & Karsten, Vegetationsbilder. 1. pl. 46.

Shortly caulescent. Trunk 1–2 m. high or sometimes prostrately elongated. Leaves 10–17 mm. wide, scarcely 1 m. long, strongly brush-tipped, typically yellowish, smooth and glossy: prickles mostly 10–15 mm. apart, 2–3 mm. long, from yellow passing through red to almost chestnut, the margin often reddish. Inflorescence 2–3 m. high. Fruit narrowly elliptical-obovate, 4–5 × 7–8 mm., the rather slender style about half as long as the rather narrow deep notch. Seed 2.5–3.5 mm.—*Pl. 2, 10, 12.*



South-central Mexico. With *Beaucarnea gracilis* and *stricta*.

Specimens examined: PUEBLA. Tehuacan (Rose, Painter & Rose, 10009, 1905,—the type; Trelease, 1903, 1905; Purpus, 3947, 1909). Esperanza (?Purpus, 1907). San Luis Tultitlanapa (?Purpus, 5082, 1908).

**D. Palmeri** Trelease.

Habit? Leaves 25 mm. or more wide, scarcely 1 m. long, somewhat brush-tipped, green or lightly glaucous, smooth, dull: prickles mostly 15–25 mm. apart, 3–5 mm. long, yellow, becoming brown upwards, the intervening margin rather smooth. Inflorescence moderately high. Fruit narrowly elliptical- or triangular-obovate, 3–4 × 6 mm., the stout style about equaling the rather open shallow notch. Seed 2 × 3 mm.—*Pl. 12.*



Northeastern Mexico.

Specimens examined: COAHUILA. San Lorenzo Cañon (Palmer, 696, 1905,—the type).

**D. Parryanum** Trelease.

Habit? Leaves becoming 10–15 mm. wide, scarcely 50 cm. long,



brush-tipped, whitened, minutely roughened and dull: prickles about 5 mm. apart, 2 mm. long, yellow, becoming red upwards, the margin very rough between them. Inflorescence moderate, exceptionally sub-simple. Perianth segments scarcely 2 mm. long.

Fruit elliptical or somewhat obovate,  $4 \times 6$  mm., the style scarcely equaling the narrow moderately deep notch. Seed?

East-central Mexico. In the region of *D. graminifolium* and *Nolina humilis* and *Watsoni*.

Specimens examined: SAN LUIS POTOSI. Vicinity of San Luis Potosi (*Parry & Palmer*, 876, 1878,—the type; *Schaffner*, 242, 1878,—mixed with *D. graminifolium*?).

Prickles prevailingly recurved.

#### **D. leiophyllum** Engelmann in herb.

*Dasylyrion* sp. Trelease, Pop. Sci. Monthly. 70: 220. f. 14.

Shortly caulescent. Leaves becoming 15–20 mm. wide, scarcely 1 m. long, somewhat brush-tipped, green or at first somewhat glaucous, smooth, rather glossy: prickles usually 10–15 mm. apart, 3–4 mm. long, yellow, usually becoming orange or red at least above the middle, the margin sometimes smooth between them. Inflorescence rather high. Perianth segments scarcely 2 mm. long. Fruit obovately subelliptical,  $4-5 \times 6-8$  mm., the thick style about equaling the moderately open and deep notch or exserted if the wings have not fully developed. Seed  $2 \times 3$  mm.—*Pl. 12.*



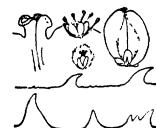
Southern Texas, in the Rio Grande region, passing into New Mexico and reaching or reappearing in central Chihuahua.—Adjoining or overlapping the range of *D. Wheeleri Wislizeni* and *Nolina erumpens* and *affinis*.

Specimens examined: TEXAS. Presidio (*Havard*, 1880,—the type). Eagle Pass (?*Havard*, 1883). Sierra Blanca (*Trelease*, 1892, 388, 1900; *Mulford*, 275, 1895; *Rose, Standley & Russell*, 12222, 1910). Van Horn (*Eggert*, 1900). NEW MEXICO. Central (*Mulford*, 424, 1895). Florida Mountains (*Mulford*, 1037, 1895). CHIHUAHUA. Sta. Eulalia Mts. (*Pringle*, 149, 1885; *Williamson*, 1885).

Fruit with very shallow notch, broadly elliptical, the style rather surpassing the wings. Prickles prevailingly upcurved.

- D. *TEXANUM* Scheele, Linnæa. 23: 140. 1850.—Bray, Bull. Univ. Tex. 82. pl. 13; Bot. Gaz. 32: 288. f.

Shortly caulescent or with buried trunk. Leaves 10–15 mm. wide, scarcely 1 m. long, somewhat brush-tipped, green, smooth or rough-keeled, glossy: prickles 5–10 mm. apart, 2–3 mm. long, yellow, becoming brownish. Inflorescence 3–5 m. high. Fruit elliptical, 4–6 × 7–8 mm., the very short style equaling or surpassing the open shallow notch. Seed ?—*Pl. 12, 15.*



South-central Texas. In the range of *Nolina texana* and *Lindheimeriana*.

Specimens examined: TEXAS. Vicinity of New Braunfels (*Lindheimer*, 548, 1845,—apparently the type, 549, 1846, 1211–1213, 1849). Blanco Cañon (*Reverchon*, 1605, 1885). Putnam (*Trelease*, 1892). Gillespie County (*Jermy*). Kerr County (*Heller*, 1929, 1894; *Bray*, 228, 1899). Hueco Tanks (*Mulford*, 90, 1895). Sanderson (*Weinberg*, 1907; *Thompson*, 1911). Marathon (*Lloyd*, 1910). Comstock (*Thompson*, 1911). Ft. Davis (*Blake*).

#### **D. texanum aberrans** Trelease.

Differing from the type in its dull somewhat glaucous leaves, 15 mm. wide.

Northern Mexico.

Specimens examined: "States of Coahuila and Nuevo Leon" (*Palmer*, 1315, 1880,—the type).

Fruit rather small (5–6 mm. wide), subcordate, the style not surpassing the wings.

#### **D. simplex** Trelease.

Acaulescent. Leaves 7–10 mm. wide, scarcely 1 m. long, rather sparsely very long-fibrous at tip, green, smooth, glossy: prickles 10–15 or 20 mm. apart, 2–3 mm. long, rather straight, prevailingly upcurved, yellow, the upper half becoming brown or finally almost black, the margin nearly smooth between them. Inflorescence (typically?) small, the staminate with one to three small branches to each division



and the pistillate simple or its divisions with a short basal branch. Fruit broadly obovate,  $5-6 \times 7$  mm., the thick style about equaling the open moderate notch. Seed (immature)  $2 \times 3$  mm.—*Pl. 12.*

North-central Mexico. In the region of *Nolina durangensis*.

Specimens examined: DURANGO. Tepehuanes (*Palmer*, 310, 1906,—the type). Santiago Papasquiaro (*Palmer*, 422, 1896).

Fruit moderately large (usually 6–8 mm. wide), the style not surpassing the wings. Prickles prevailingly upcurved.

Leaves not brush-tipped, glaucous.

D. GLAUCOPHYLLUM Hooker, Bot. Mag. iii. 14. *pl. 5041.* 1858.—[As *Dasyligium*.]—Baker, Journ. Bot. 10: 298. 1872.—?Gard. Chron. iii. 40: 247. *f. 101.*

*D. glaucum* Carrière, Revue Hort. 44: 435. *f.* 1872.—Copied in Garden. 3: 23. *f.*, and Florist and Pomol. 1874: 17. *f.*—Gard. Chron. n. s. 13: 82, 205. *f. 37.*—??Roezl, Belg. Hort. 33: 139.

?*D. serratifolium* Rept. Mo. Bot. Gard. 14: 12. *f.*

*Bonapartea glauca* Hort.

Shortly caulescent. Trunk scarcely 5 m. high. Leaves as much as 12 mm. wide, over 1 m. long, glaucous, nearly or quite smooth, dull: prickles 5–10 mm. apart, 2 mm. long, yellowish white or the tips becoming slightly brownish. Inflorescence 4–6 m. high. Fruit sub-elliptical,  $6 \times 9-10$  mm., the thick style about half as long as the closed deep notch. Seed  $2.5 \times 4$  mm.—*Pl. 12.*

East-central Mexico. In the region of *D. acrotriche* and *Calibanus*.—The type locality is Real del Monte.

Known to me only in cultivation. The fruit description is based on material cultivated at La Mortola (*Berger*, 560, 1911).

Leaves more or less brush-tipped.

Leaves narrow (scarcely 10 mm.), strongly brush-tipped.

D. ACROTRICHE Zuccarini, Abhandl. Akad. München. Cl. II. 3  
(=Denkschr. 16): 226, 228. *pl. I. f. iv.* 1840.

*Yucca acrotricha* Schiede, Linnæa. 4: 230. 1829; 6: 52.—Schultes, Syst. 7: 1716. 1830.

*Roulinia gracilis* Brongniart, Ann. Sc. Nat., Bot. ii. 14: 320.  
1840.



*Barbacenia gracilis* Brongniart, l. c.—As synonym.

*Yucca gracilis* Otto, Allgem. Gartenzeit. 9: 123. 1841.—As synonym.

*Bonapartea gracilis* Otto, l. c.—As synonym.

*Dasyliion gracile* Zuccarini, Abhandl. Akad. München. Cl. II. 4  
(=Denkschr. 19): 22. 1845.

*Dasylium acrotrichum* Kunth, Enum. Pl. 5: 40. 1850.—Hooker,  
Bot. Mag. iii. 14. pl. 5030.—Copied in Fl. des Serres. 14. pl.  
1448.—Schlotthauber, Deutsch. Mag. f. Gart.-u. Blumen-  
kunde. 1871: 49, 64, 81, 96. 2 pl.—Koopmann, Gartenwelt. 3:  
375–6. f.

*Dasylium gracile* Planchon, Fl. des Serres. 7: 6, 10. f. 1851–2.

*Littaea gracilis* Verschaffelt, Cat. 1864.—Hansgirg, Phyllobiologie. 422.

*Dasyliion acrotrichum* Baker, Journ. Bot. 10: 297. 1872.—  
Regel, Gartenflora. 30: 24. f.—Gard. Chron. iii. 19: 204. pl.  
—Deutsch. Gärtner-Zeit. 20: 536. f.

?*D. robustum* Hort.—(Perhaps = *serratifolium*.)

Caulescent. Trunk at length 1 m. or more high. Leaves 6–10  
or rarely 15 mm. wide, less than 1 m. long, green  
and glossy or somewhat glaucous and dull, often  
rough on the keels: prickles 5–10 or 15 mm. apart,  
scarcely 2 mm. long, rather straight, pale yellowish,  
with slightly brown tips. Inflorescence 3–5 m. or  
more high. Perianth segments 2–3 mm. long. Fruit round-cordate,  
 $6\frac{1}{2} \times 8\frac{1}{2}$  mm., the thick style about equaling the shallow notch.  
Seed  $3 \times 3.5$  mm.—Pl. 11, 12.



East-central Mexico. Collected by Schiede and Deppe on the Serro de la Ventana, on the flanks of Mt. Orizaba, by Karwinski at Ixmiquilpan, and by Reppert at Real del Monte. Deppe's original seed collection, in 1825 (Otto, Allgem. Gartenzeit, 16: 276. 1848) was made between Real del Monte and Pachuca, and most of the earlier plants of European gardens were raised from this at Berlin (Bouché, Monatsschr. Verein Beförd. Gartenbau. 1880: 481).—Range of the preceding.

Specimens examined: HIDALGO. Dublan (Pringle, 11196, 1902;

*Rose & Hay*, 5305, 1901). Metepec (*Pringle*, 10001, 1904). Tula (*Pringle*, 6637, 1897; *Rose, Painter & Rose*, 8280, 1905). Ixmiquilpan (*Rose, Painter & Rose*, 8969, 9029, 1905). Sierra de Pachuca (*Rose, Painter & Rose*, 5571, 1901; 8801, 1905; *Rose & Rose*, 11484, 1906). QUERETARO. Cadereyta (*Rose, Painter & Rose*, 9714, 1905). SAN LUIS POTOSI. San Luis Potosi (*Parry & Palmer*, 876, 1878).

Leaves wide (rarely under 15 mm.), only moderately brush tipped.

Fruit elliptical or obovate.

Prickles small.

D. GRAMINIFOLIUM Zuccarini, Allgem. Gartenzeit. 6: 259, 303. 1833;  
Abhandl. Akad. München. Cl. II. 3 (= Denkschr. 16): 225.

pl. 1, f. 1. 1840.—Kunth, Allgem. Gartenzeit. 9: 121. pl. 1.

*Yucca graminifolia* Zuccarini, Cat. Hort. Monac. 1837.

*Dasyliurum graminifolium* Kunth, Enum. Pl. 5: 39. 1850.

Subcaulescent? Leaves 12 mm. wide, about 1 m. long, green,



smooth, glossy: prickles mostly 5–10 mm. apart, 1 mm. long, yellowish white or with slightly darkened tips. Inflorescence moderately high. Fruit broadly elliptical, 6 × 8–9 mm., the thick style equaling the rather open shallow notch. Seed?—Pl. 12.

East-central Mexico. The type is said by Otto to have been raised from seed sent with that of *D. acrotriche* by Deppe in 1827.—As the earliest well-characterized and figured species, this may perhaps be accepted as the type of the genus, though it follows *D. serratifolium* in position.—In the region of *D. Parryanum*, *Calibanus* and *Nolina humilis* and *Watsoni*.

Specimens examined: SAN LUIS POTOSI. Vicinity of San Luis Potosi (*Parry & Palmer*, 876, 1878; ?*Schaffner*, 242, 1878,—mixed with *D. Parryanum*). Las Canoas (*Pringle*, 3746, 1891).

Leaves of *D. hybridum* of the Botanical Garden of Rome do not differ from this except in being 15–20 mm. wide, nearly dull and scarcely brush-tipped. It is said to be a hybrid between *D. [Nolina] longifolium* and *D. serratifolium*, but in foliage shows no characters of the former, and it is unlike the latter as I understand it.

Prickles moderate.

**D. durangense** Trelease.

Habit? Leaves 20 mm. wide, scarcely 1 m. long, lightly glaucous, nearly smooth, dull: prickles 5–10 mm. apart, 2–3 mm. long, yellow, with orange tips. Inflorescence tall. Fruit broadly elliptical-cordate, 7–8 × 9 mm., the thick style scarcely half as long as the rather open deep notch. Seed 2 × 3 mm.—*Pl. 11, 12.*



North-central Mexico. In the region of *Nolina durangensis*.

Specimens examined: DURANGO. Durango (*Palmer*, 557, 1896,—the type).

**D. SERRATIFOLIUM** Zuccarini, Allgem. Gartenzeit. 6: 258, 303,—name only. 1838; Abhandl. Akad. München. Cl. II. 3 (= Denkschr. 16): 225, 228. *pl. I. f. iii.* 1840.—Roezl, Belg. Hort. 33: 139.

*Yucca serratifolia* Schultes, Syst. 7. 1716. 1830.

*Roulinia serratifolia* Brongniart, Ann. Sc. Nat., Bot. ii. 14: 319. 1840.

*Dasyliurum serratifolium* Kunth, Enum. Pl. 5: 41. 1850.

*Dasyliurion laxiflorum* Baker, Journ. Bot. 10: 299. 1872.

?*D. robustum* Hort.

Subacaulescent. Leaves 15–20 or even 35 mm. wide, scarcely 1 m. long, whitish, finely roughened on one or both faces, dull: prickles 5–10 or even 20 mm. apart, 2–3 mm. long. Inflorescence ample. Fruit quadrately round-obovate, the style equaling the narrow rather deep notch. Seed 3 × 4 mm.

Southeastern Mexico. Collected by Andrieux near Oaxaca, and by Karwinsky at San Jose del Oro.—Region of *Nolina longifolia*.

Specimens examined: OAXACA. Las Sedas (*Pringle*, 6697, 1897). Nochistlan (*Conzatti & Gonzales*, 1899).

**D. WHEELERI** Watson in Rothrock, Rept. Wheeler. 6: 378. 1878; Proc. Amer. Acad. 14: 249. 1879.—Wooton, Bull. N. Mex. Exper. Sta. 18: 92. *pl.*—Lloyd, Plant World. 10: 254. *f. 51.*—MacDougal, Publ. Carnegie Inst. 99: 74, *pl. 58.*—De Wildeman, Icones Sel. Hort. Thenensis. 6: 91. *pl. 225.*—Sketchy habit figures, without name, are given by Schott in Emory, Rept. Bound. Surv. 1. *pl. 37, 42.*



Shortly caulescent. Trunk scarcely 1 m. high. Leaves 15–20 or 25 mm. wide, scarcely 1 m. long, glaucous, nearly smooth, dull: prickles 5–10 mm. apart, 2–3 mm. long, yellow, becoming brown upwards. Inflorescence 3–5 m. high. Fruit round-obovate, 6–7 × 7–9 mm., the style normally about equaling the open moderately deep notch. Seed (immature) 3 mm. long.—*Pl. 7, 8, 11, 12.*

Southeastern Arizona and adjoining Mexico, New Mexico and Texas. Region of *Nolina microcarpa* and *caudata*.

Specimens examined: ARIZONA. Ash Creek, etc. (*Rothrock*, 329, 655,—the types). Rio Grande to Gila Rivers (*Emory*, 1846). Sunflower Valley (*Girard*, 1873). Dragoon Summit (*Vasey*, 1881). Sta. Catalina Mountains (*Lemmon*, 1881; *Pringle*, 1881; *Toumey*, 1894). Without locality (*Pringle*, 1884). Sta. Rita Mountains (*Brandegee*, 1891). Ft. Huachuca (*Wilcox*, 208, 264, 1894). Chiricahua Mountains (*Toumey*, 1894). San Carlos (*Straub*, 1895). Nogales (*Coville*, 1623, 1903; *Thompson*, 1911). White Tail (*Pilsbry*, 1906). Benson (*Rose, Standley & Russell*, 12326, 1910). NEW MEXICO. Silver City (*Greene*, 1880; *Metcalfe*, 637, 1903). Burro Mountains (*Rusby*, 413, 1881,—leaves). Pinal Mountains (*Toumey*, 449, 1892). Las Cruces (*Wooton*, 72, 1897). Mangos (*Metcalfe*, 1897). Kingston (*Metcalfe*, 1014, 1904). Alamogordo (*Rehn & Viereck*, 1902). Organ Mountains (*Standley*, 1906). TEXAS. El Paso (*Evans*, 1891). Tortugas Mountains (*Rose, Standley & Russell*, 12254, 1910). BOUNDARY LINE (*Parry et al.*). CHIHUAHUA. Lake Sta. Maria (*Nelson*, 6393, 1899).

Fruit triangular-obcordate: prickles moderate.

#### D. Wheeleri Wislizeni Trelease.

Shortly caulescent. Leaves 15–20 mm. wide, scarcely 1 m. long, green or slightly glaucous, typically smooth and rather glossy: prickles 5–10 mm. apart, 2–3 mm. long, red-brown or with yellow base, the intervening denticles often reddish. Inflorescence ample. Fruit triangular-obcordate, 6–7 × 8–9 mm., the thick style about equaling the open moderately deep notch. Seed (immature) 3 mm. long.—*Pl. 12.*



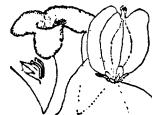
North-central Mexico and adjacent Texas,—apparently grading into *D. Wheeleri*. Adjoining or overlapping the area of *D. Wheeleri* and *Nolina erumpens*.

Specimens examined: CHIHUAHUA. Paso del Norte [Juarez] (*Wislizenus*, 218, 1846,—the type; *?Stearns*, 1910,—with smaller, slightly roughened dull leaves). Without locality (*Thurber*, 1852). TEXAS. El Paso (*Dewey*, 1891; *Wagner*, 985, 1892). Franklin Mountains (*Rose, Standley & Russell*, 12280, 1910).

Fruit large (8–9 mm. wide), the style surpassing the wings.

*D. BERLANDIERI* Watson, Proc. Amer. Acad. 14: 249. 1879.

Habit? Leaves? Inflorescence apparently ample. Bractlets rather long, lanceolate, finely toothed. Perianth segments 2–4 mm. long. Fruit round-elliptical, 7–9 × 7–10 mm., the style rather exceeding the very open moderately deep notch. Seed ?—*Pl. 12*.



Northeastern Mexico.

Specimens examined: NUEVO LEON. La Silla, Monterey (*Berlandier*, 3218, June, 1843,—the type).

Leaves 4-sided, unarmed.

QUADRANGULATÆ.

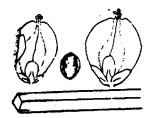
*D. LONGISSIMUM* Lemaire, Ill. Hort. 3. misc. p. 91. 1856.

*D. quadrangulatum* Watson, Proc. Amer. Acad. 14: 250. 1879.—*Gartenflora*. 36: 280. f. 75.—Bull. Soc. Tosc. Ort. 9: 236. f.; 35: 331. pl. 6.—*Die Natur*. 34: 340. f.—*Hooker, Bot. Mag.* iii. 56. pl. 7749.

*D. juncifolium* Rehnelt, *Gartenwelt*. 11: 77. f. 1906.

Caulescent. Trunk 1–2 m. high. Leaves narrowly linear, 3–8 mm. wide, at length 2 m. long, not brush-tipped, green, dull, rhombic or square in section, smooth, the edges minutely granular-roughened or further with very low elevations 10–30 mm. apart representing the prickles of other species. Inflorescence 2–6 m. high. Perianth segments 3–4 mm. long. Fruit broadly obovate or elliptical, 5–8 × 7–10 mm., the style surpassing the open very shallow notch. Seed 3 × 3–4 mm.—*Pl. 9, 12*.

Eastern Mexico. Of wide range, overlapping the regions of *Nolina Nelsoni*, *Calibanus* and *D. acrotriche*.



Specimens examined: TAMAULIPAS. Sierra Nolas, between San Luis Potosi and Tampico (*Palmer*, 1878-9,—the type of *D. quadrangulatum*). Miquihuana (*Nelson*, 4480, 1898). SAN LUIS POTOSI. Minas de San Rafael (*Purpus*, 5009, 1910,—a form with small fruit,  $4 \times 4$  mm., with style and wings abbreviated and equal). HIDALGO. Sierra de la Mesa (*Rose, Painter & Rose*, 9097, 1905,—called “junquillo”).

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- <sup>12</sup> Lloyd, Plant World. 10: 254-5. f. 51. 1907.
- <sup>13</sup> McClendon, Amer. Nat. 42: 308. ff. 1908.
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#### EXPLANATION OF ILLUSTRATIONS.

The distribution map indicates the occurrence of specimens actually examined. Half-tone plates are from unpublished photographs by the author unless otherwise credited. Text-cuts are uniformly reduced from enlarged camera lucida drawings to natural size except that leaf sections are  $\times 2$ , the finer arming of leaf margins  $\times 20$ , and the style and wing tips of *Dasyliion*  $\times 6$ ; and a few exceptional details with other enlargement are introduced.

PLATES 1–4. Habit of growth: 1, Trunkless (*Nolina microcarpa*, Arizona, MacDougal); 2, with elongated finally erect caudex (*Dasyliion lucidum*, Tehuacan); 3, arborescent (*Nolina longifolia*, cultivated in the Palermo botanical garden); 4 arboreous (*Beaucarnea gracilis*, Tehuacan). All greatly reduced.

PLATE 5. Habit of inflorescence:—A, Simply paniced (*Nolina georgiana* Georgia, Harper); B, Compoundly paniced (*N. Parryi*, California, Jepson); C, Compoundly spicate (*Dasyliion cedrosanum*, Mexico, Lloyd).—All greatly reduced.

PLATES 6–7. Inflorescence details:—6 A, *Nolina caudata* (type); 6 B, *Calibanus Hookerii* (Purpus, 4775); 7 A, *Beaucarnea guatemalensis* (Kellerman, 6669); 7 B, *Dasyliion Wheeleri* ♂ and ♀ (Wooton, 72).—All natural size.

PLATE 8. Flowers.—A, *Nolina longifolia* (Radlkofer); B, *Calibanus Hookerii* (Rose, 8954); C, *Beaucarnea stricta* (Purpus, 2397); D, *Dasyliion Wheeleri* (Toumey).—All  $\times 10$ .

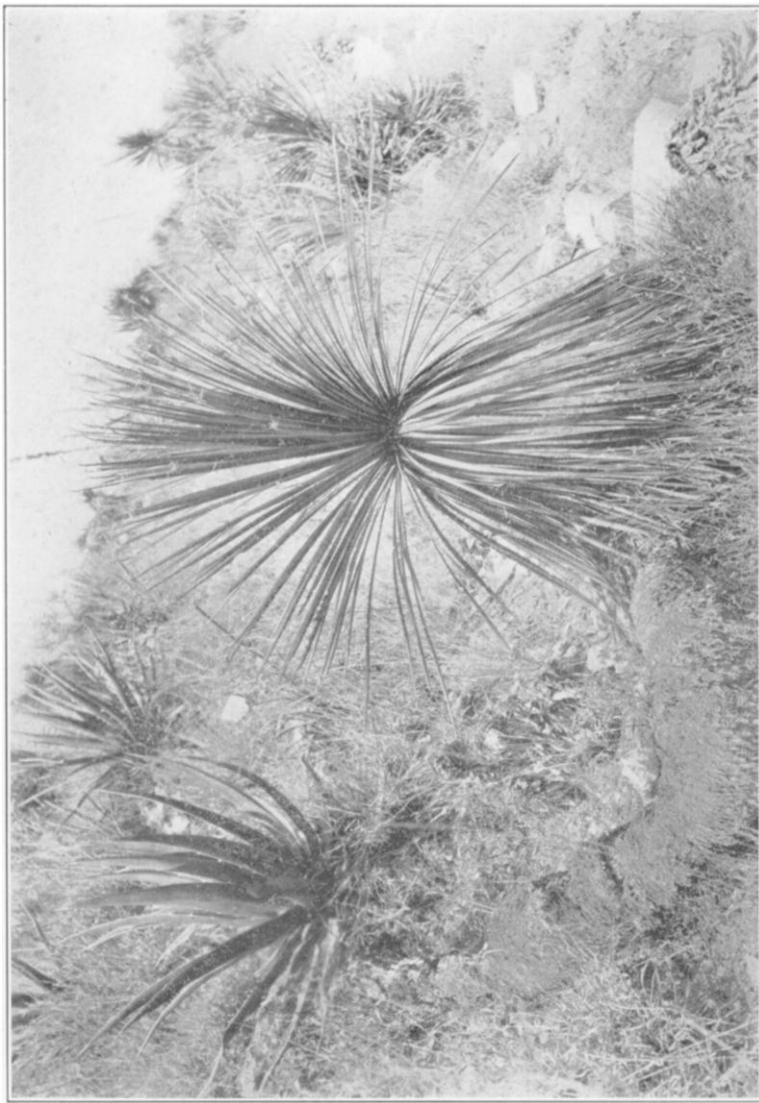
PLATE 9. Septal nectar slits as shown on the matured fruit. A, *Dasyliion longissimum* (Palmer); B, *Calibanus Hookerii* (Purpus, 1200).—Both  $\times 25$ .

PLATE 10. Seeds. A, three seeds of *Nolina durangensis*,—the middle one sectioned to show coat, endosperm and embryo; a seed of *Beaucarnea plabilis*; and two seeds of *Dasyliion lucidum*.—All  $\times 3$ . B, endosperm of *Dasyliion lucidum*, with “reserve-cellulose” walls.  $\times 200$ . C, cross section of seed of *Nolina durangensis* showing embryo cavity with much extruded protoplasm and oil—in chlor-iodide of zinc.  $\times 20$ . D, endosperm of *Nolina durangensis* swollen in chlor-iodide of zinc, with extruded oil.  $\times 200$ .

PLATE 11. Fruit characters. A, four fruits and a seed of *Nolina georgiana*; six fruits and two seeds of *Dasyliion Wheeleri*; six fruits and two seeds of *Beaucarnea gracilis*; and four fruits and a seed of *Calibanus Hookerii*.—All natural size. B, 1, *Dasyliion acrotriche* (3 and 4-winged); 2, *D. acrotriche* (4- and 5-winged); 3, *D. durangense* (2- and 5-winged); 4, *D. Wheeleri* (4- and 5-winged); 5, *Calibanus Hookerii* (4-carpellary).—All  $\times 2$ .



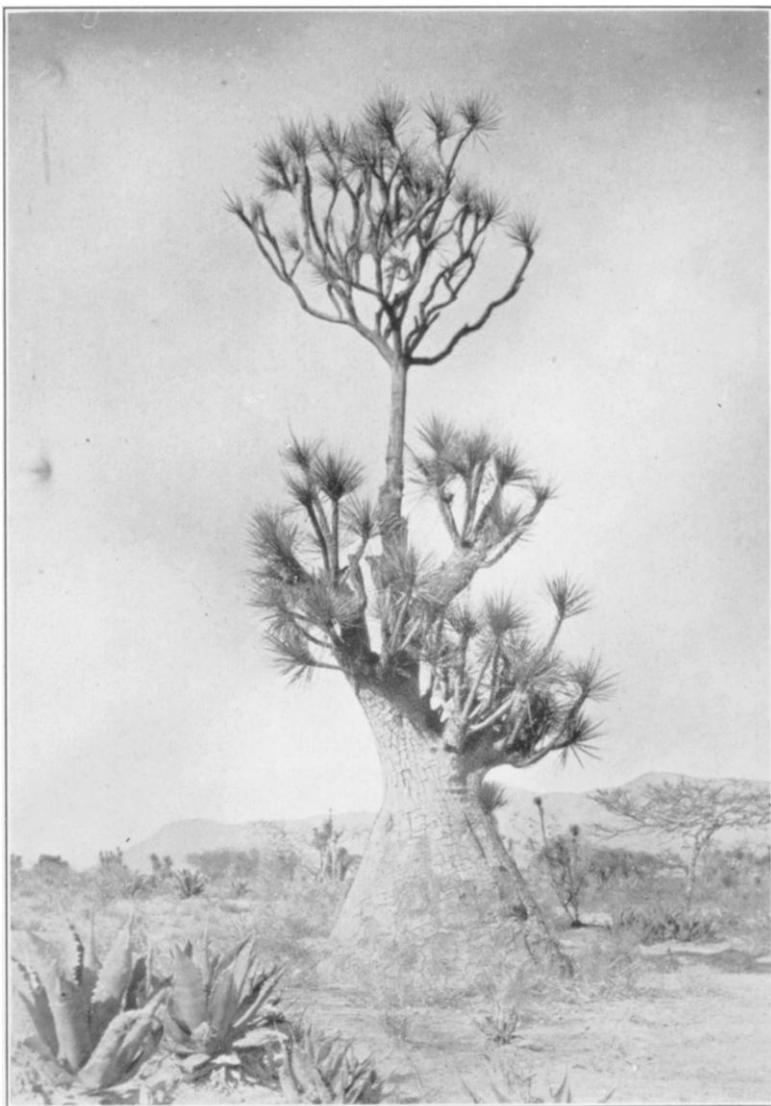
**NOLINA MICROCARPA**



DASYLLIRION LUCIDUM



NOLINA LONGIFOLIA



BEAUCARNEA GRACILIS



A.—*Nolina*

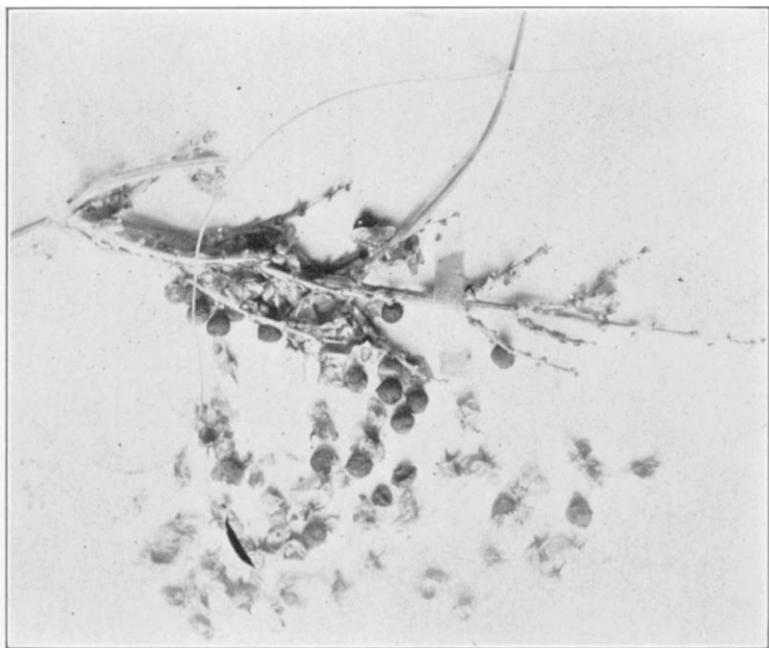


B.—*Nolina*

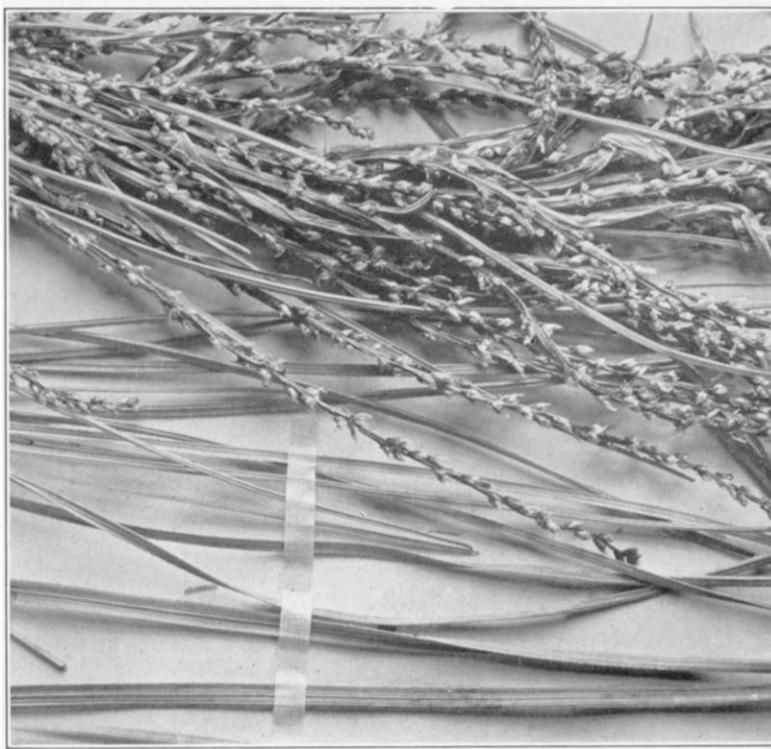


C.—*Dasylirion*

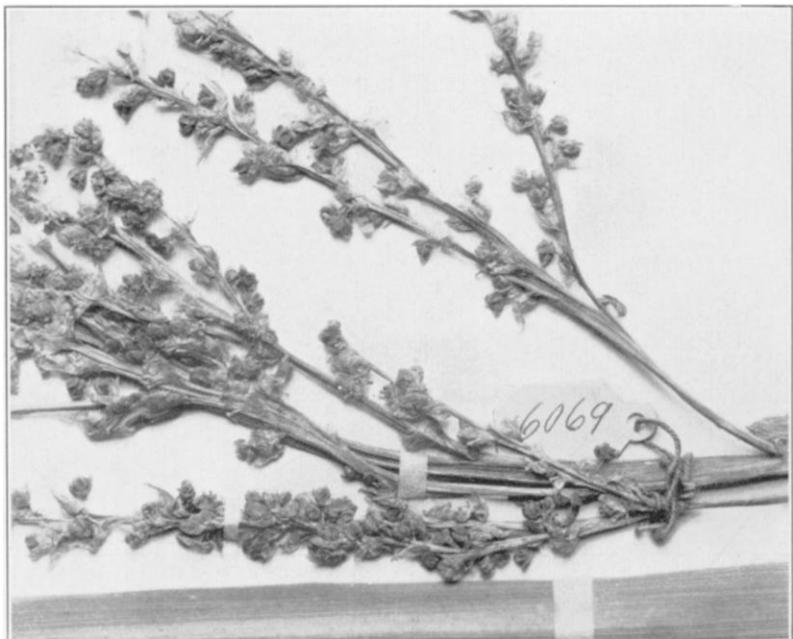
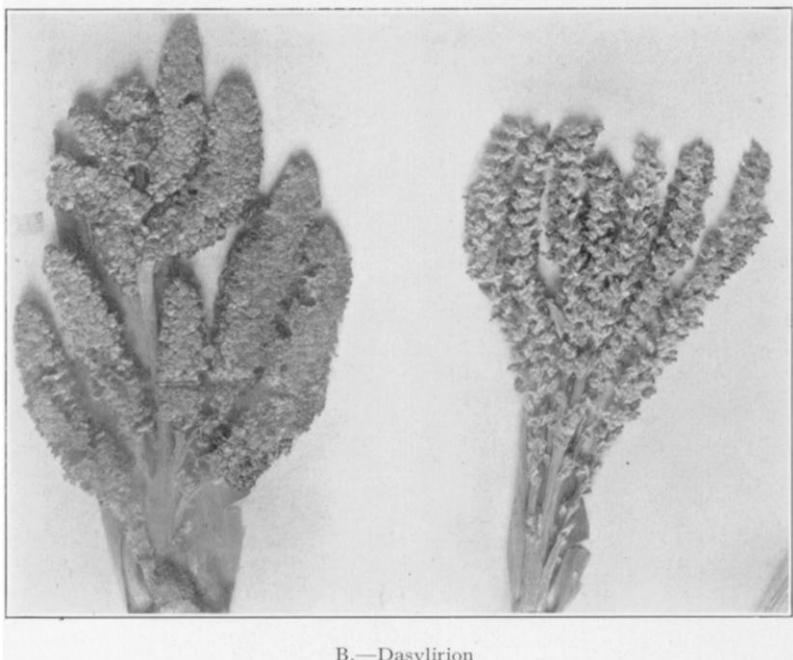
INFLORESCENCE OF NOLINEAE

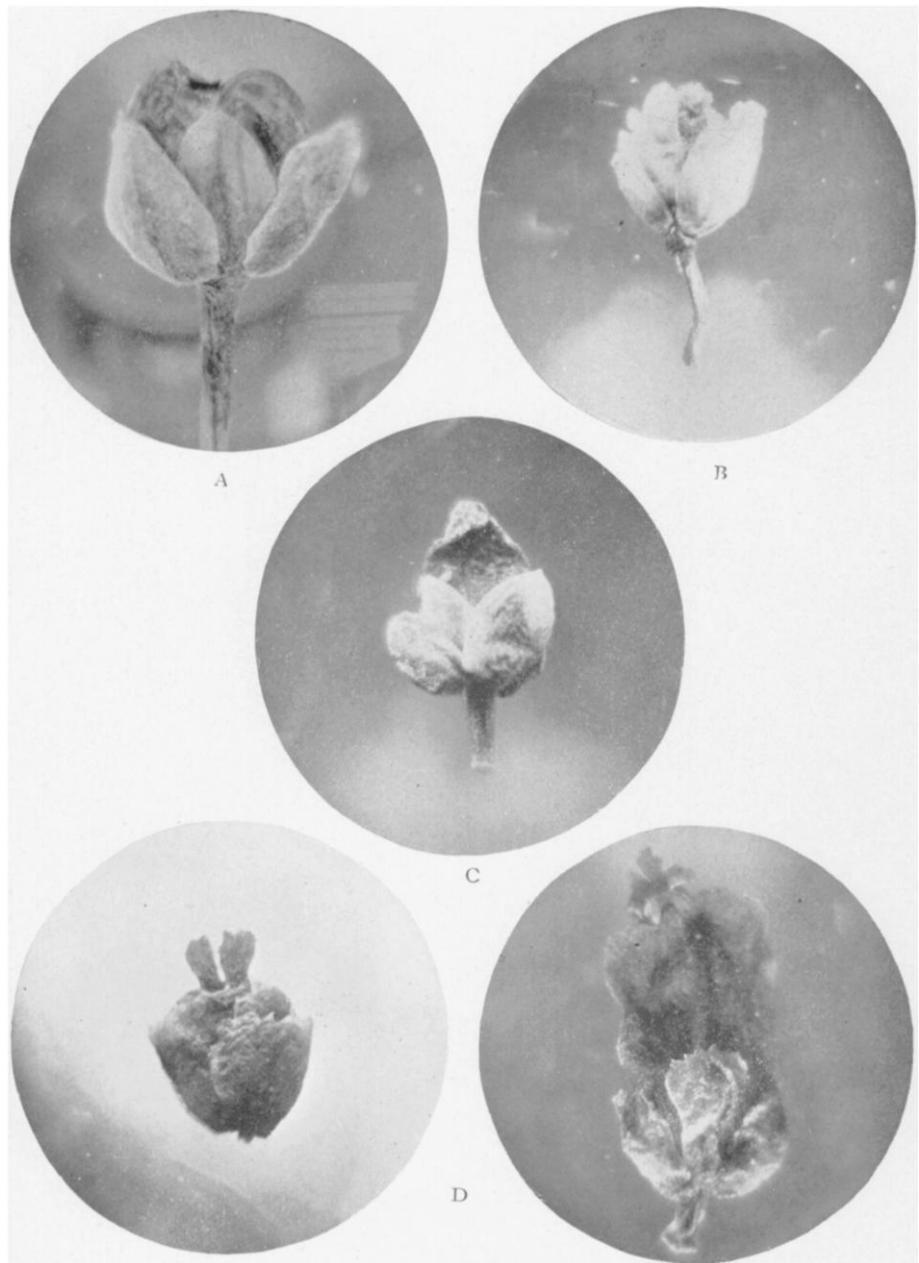


A.—Nolina

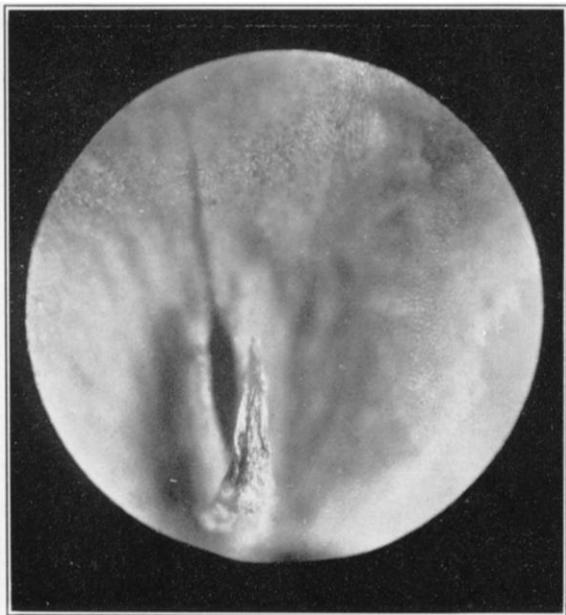


B.—Calibanus

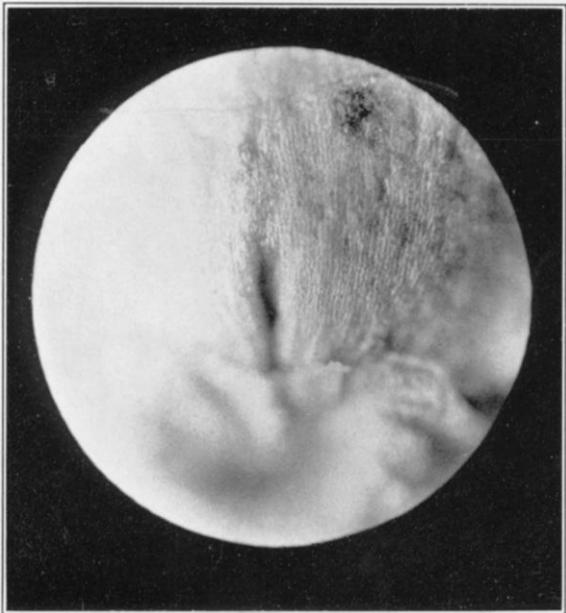
A.—*Beaucarnea*B.—*Dasylirion*



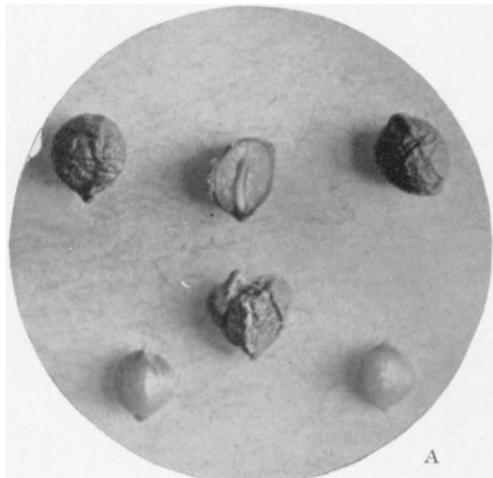
FLOWERS OF NOLINEAE



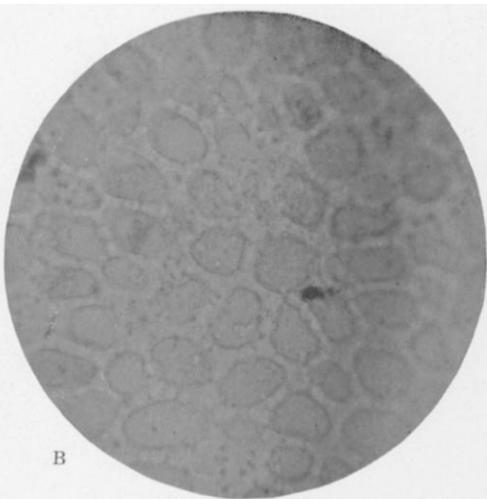
A.—Dasylirion



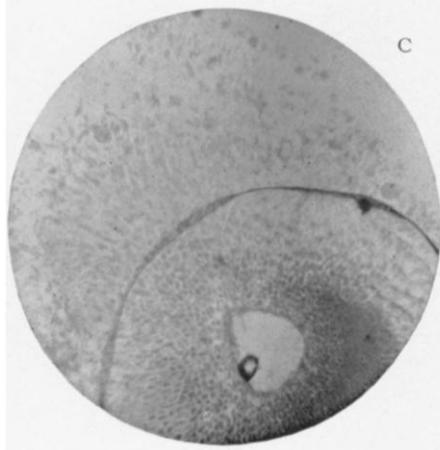
B.—Calibanus



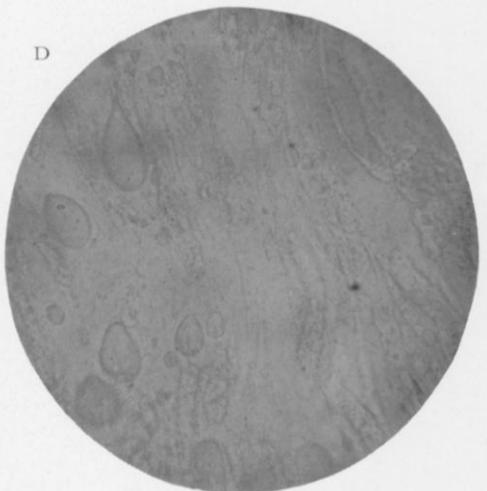
A



B

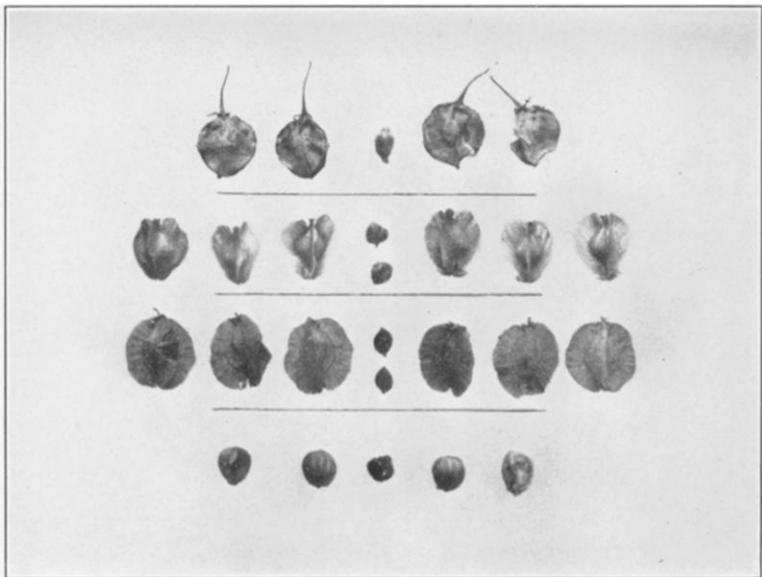


C

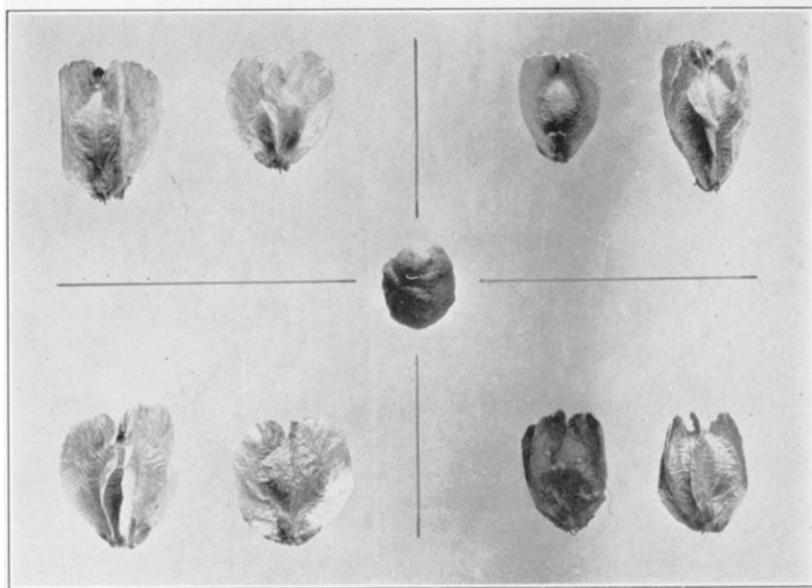


D

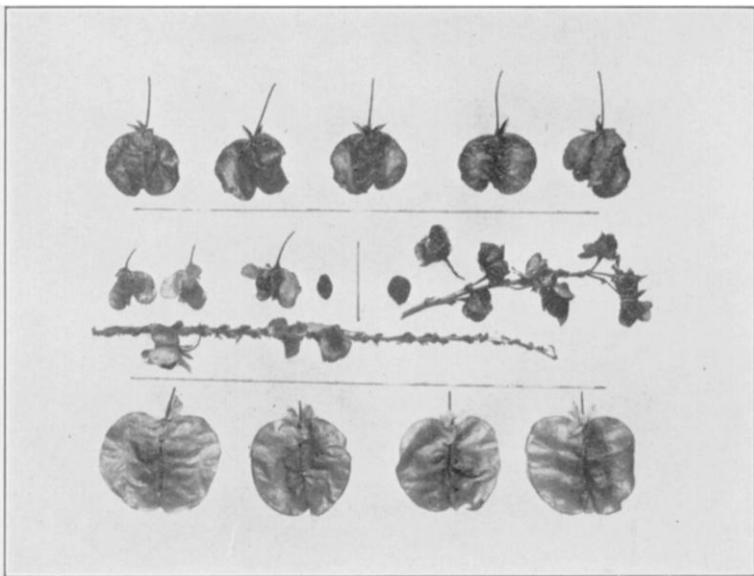
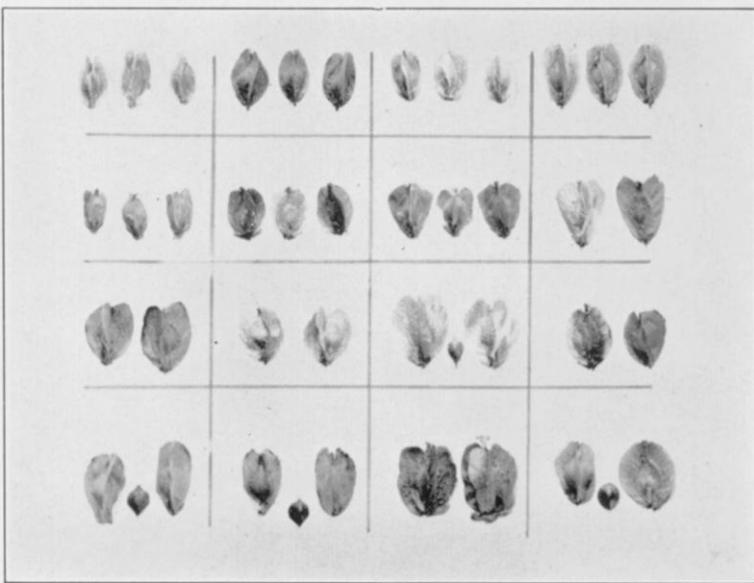
SEEDS OF NOLINEAE

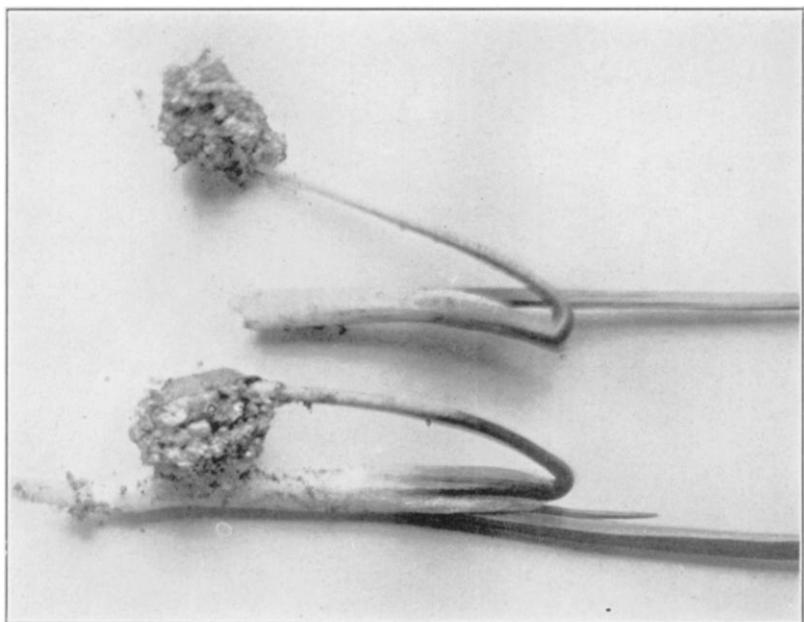


A.—Normal

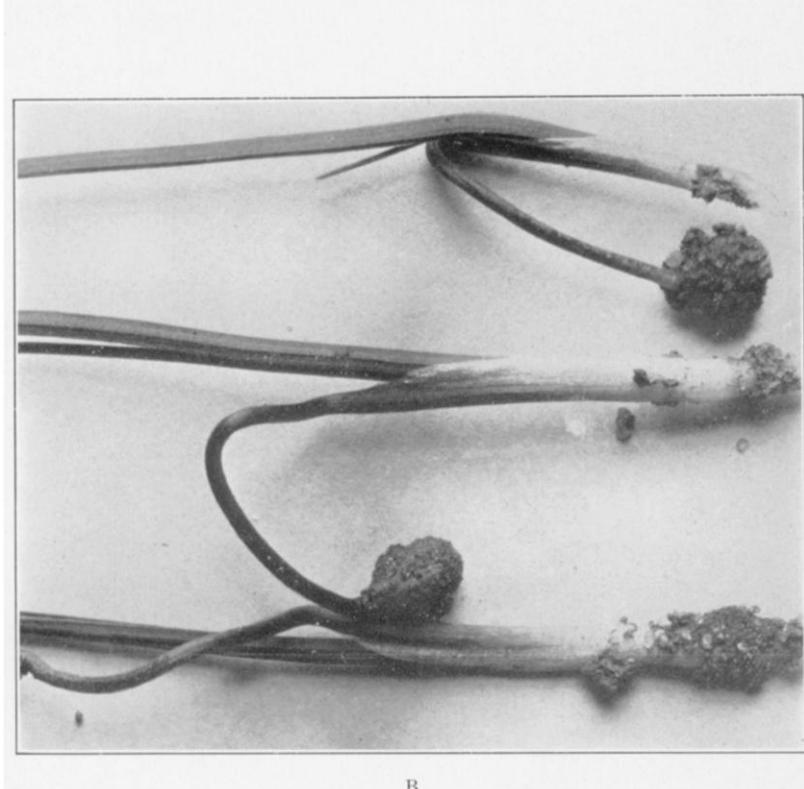


B.—Teratological

A.—*Nolina*B.—*Dasylirion*

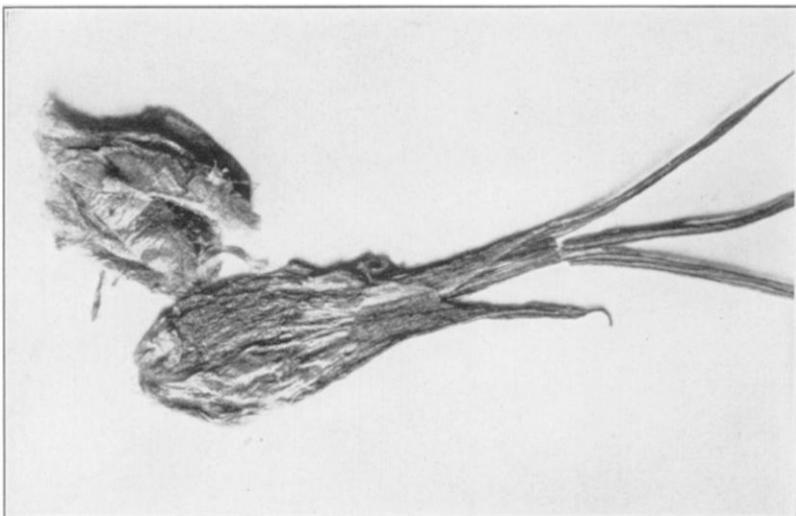


A

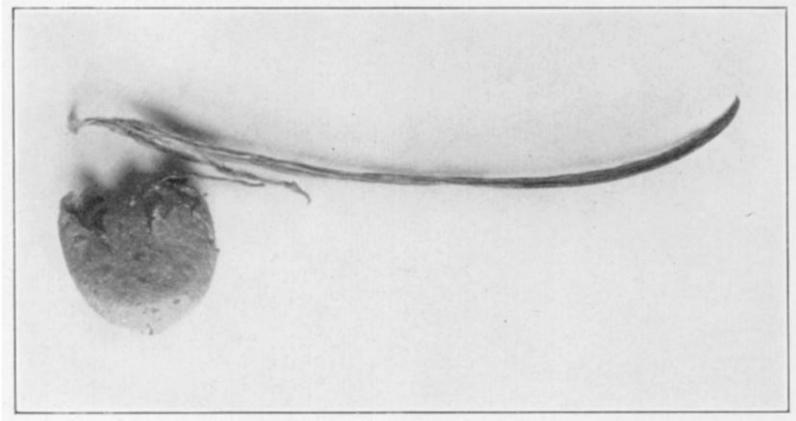


B

GERMINATION OF *NOLINA LONGIFOLIA*

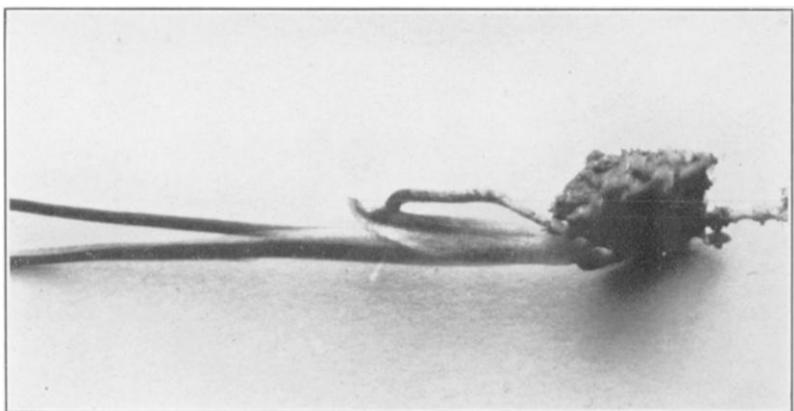


A.—*Beaucarnea*

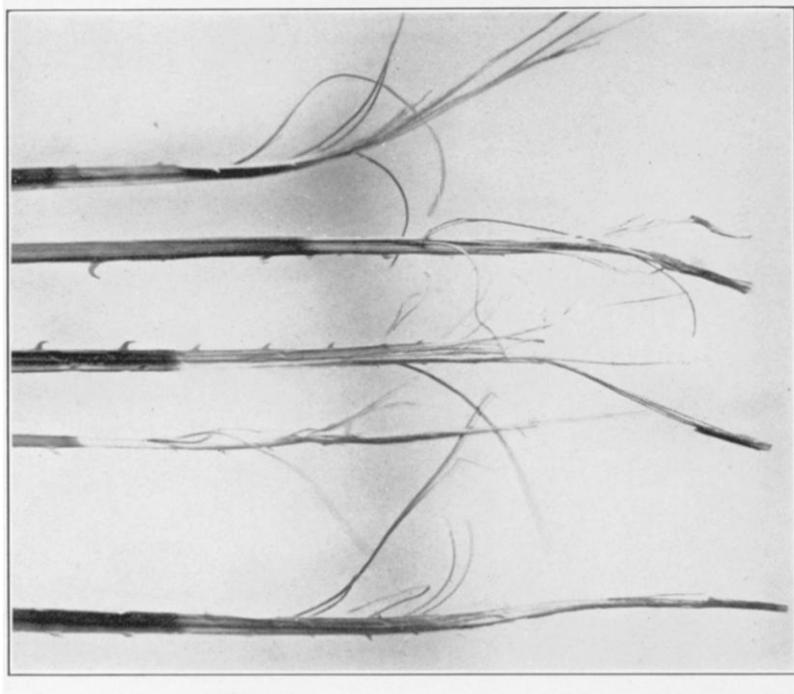


B.—*Calibanus*

GERMINATION OF NOLINEAE



A

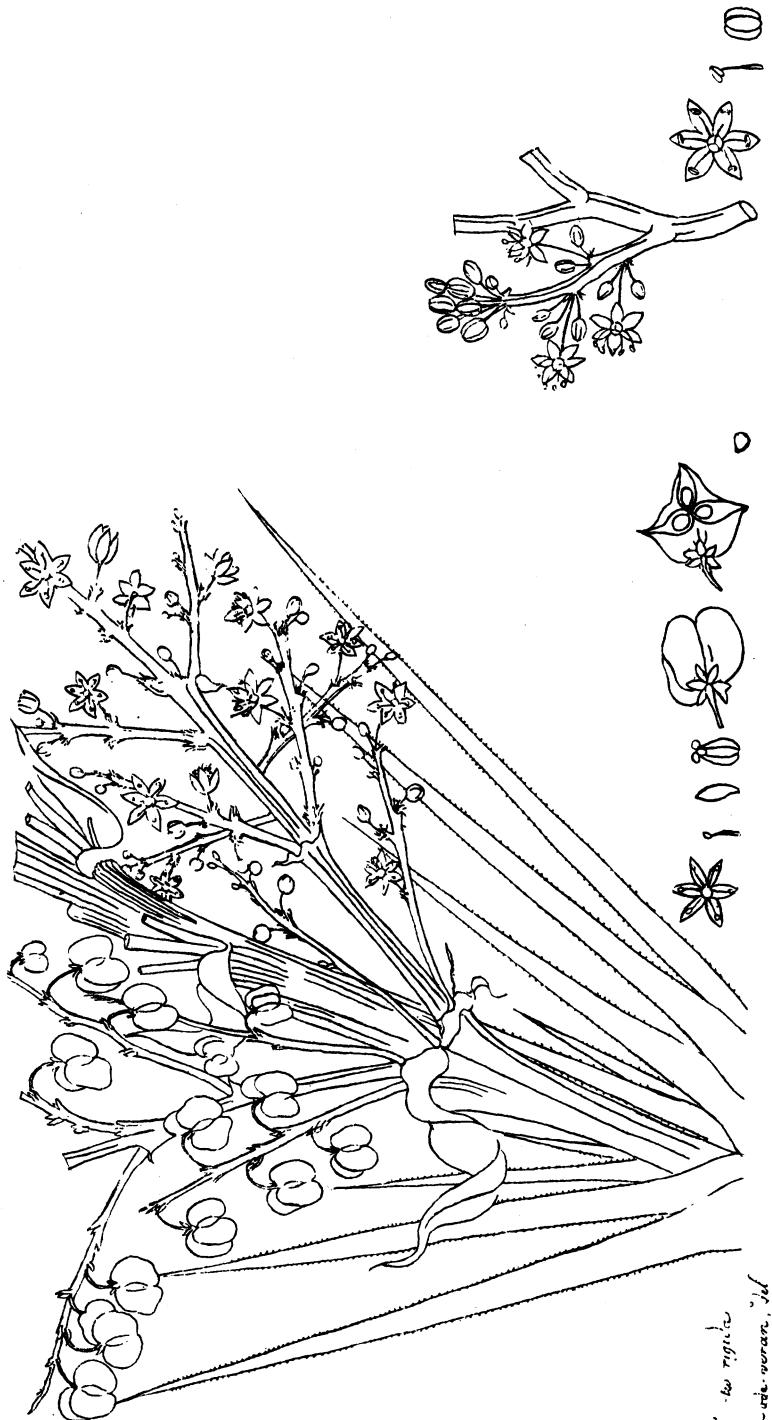


B

HAUSTORIUM AND LEAF TIPS OF DASYLIRION



*NOLINA HARTWEGIANA*



NOLINA RIGIDA

PLATE 12. Fruit characters. A, *Nolina*: Graminifoliæ (four fruits of *N. Lindheimeriana*),—Microcarpæ (branchlet of *N. microcarpa*),—Erumpentes (branchlet of *N. texana*),—and Arborescentes (four fruits of *N. Parryi*).—All natural size. B, *Dasylirion*: 1, *D. cedrosanum* (type),—2, *D. lucidum* (Trelease, 26),—3, 4, *D. leiophyllum* (3, Van Horn, Eggert, 4, type),—5, *D. Palmeri* (type),—6, *D. texanum* (Lindheimer, 1213),—7, *D. simplex* (type),—8, *D. Wheeleri Wislizeni* (type),—9, 10, *D. Wheeleri* (9, Girard, 10, Wooton, 72),—11, *D. durangense* (type),—12, *D. graminifolium* (Pringle, 3746), 13, *D. glaucophyllum* (Berger), 14, *D. acrotriche* (Haage & Schmidt),—15, *D. Berlandieri* (type),—16, *D. longissimum* (type).—All natural size; four numbers in a row, from left to right.

PLATE 13. Germination of *Nolina longifolia*.—A, normal seedlings, one with slightly shouldered haustorium. B, various straightening of the cotyledon from normal arch to erect form.—All  $\times 3$ .

PLATE 14. Germination. A, *Beaucarnea stricta*,—the haustorium in place, though broken off (Rose). B, *Calibanus Hookerii* (Rose). The haustorium deeply dorsal on the cotyledonary sheath.—Both  $\times 3$ .

PLATE 15. A, *Dasylirion cedrosanum*, seedling with deeply dorsal haustorium,  $\times 3$ ; B, *D. texanum*, mature leaf tips showing dorsal exfoliation of fibers, natural size.

PLATE 16. *Nolina Hartwegiana*. (Hartweg, 406, in Herb. Delessert). C. de Candolle.—Reduced.

PLATE 17. *Nolina rigida*. *Anatis rigida*. (Plate XVIII of the Sese and Moçiño drawings in Herb. DC., by Node-véran.) C. de Candolle.—Natural size.